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Editorial Notes

The Kitchen Front

"THERE is one line of defence which all of us can hold. It is the line of Food Defence, where we must be constantly on our guard to prevent waste. We must be provident and adaptable. We must seek, day by day, to make the best use of varying food supplies. We must take thought about our food, and plan our buying and our cooking wisely.

"With care, and care is essential, we need not fear that we shall have less food than we require for efficiency and health. Supplies will be maintained, but it is our duty to see that no unnecessary strain is placed upon our seamen.

"This is the direct contribution to the national war effort which we can make in our own homes. No other service is so close to our hands. To one and all of us the opportunity comes every day.

"It is the simplicity of this duty, and of my call, which may tend to hide its full reality. But no one can doubt who remembers how much of our food comes from overseas—more than 20 million tons in a peace-time year. Let us picture the convoys, bringing the cargoes to our shores. Let us think of our food in terms of men's lives, and let us be very careful.

"The movement is a national movement. All of us must understand and take part. I ask you to carry its message over the whole country, so that in this most effective way all our people may make their contribution to our united strength."

Queen's Hall last Friday afternoon saw the launching of the Ministry of Food's nation-wide campaign, when representatives of many organizations gathered in force to take their orders for the conduct of the crusade. The quotation above, of words which appeared in the programme over the signature of Lord Woolton, give the keynote. Nobody envied the new Minister of Food his task, realizing that greatness had been thrust upon him only about 24 hours previously, but the ground had been assiduously prepared by many weeks of careful thought by his predecessor and his Department, and, with the support of Mrs. Neville Chamberlain in the chair and other eminent speakers, the campaign may be said to have received an excellent send-off.

To all thinking men and women the importance of the Food Front is so self-evident that it needs no words of ours to emphasize it. What seems most necessary is to bring home to every individual that no exceptions to rules can be countenanced; that, for example, the one teaspoonful of tea "for the pot," if it is the practice of 45 million people, amounts to sixty shiploads of tea a year. To bring facts like this home to every household will undoubtedly need a great deal of that kind of repetition which goes by the ugly name of propaganda, and for this the Ministry of Food must make itself mainly responsible. But there are other forms of waste besides the direct kind. "We waste food just as much by cooking it badly as we do by throwing it away," is a quotation from one of the Minstry's new pamphlets, and this is where the Gas Industry finds its opportunity of taking a leading part in this great win-the-war effort.

It has been no secret for some time that the Ministry, in the preparation of its campaign, had wisely sought the advice and enlisted the help of the Gas Industry—among others well qualified to play a part—and the British Commercial Gas Association, with Mrs. Eileen Murphy as liaison officer, has been co-operating behind the scenes. The Industry's Home Service is well known; it has wide experience in food education and exceptional facilities for contacting women; it is ready to march. As we announced last week, the Gas Industry's special campaign is to be launched at a Luncheon to be held at the Dorchester Hotel on Friday this week, when the Minister of Food will be the chief guest and speaker. Material for local use has been prepared by the Association, covering advertisements, films, editorials, window displays, ideas for demonstrations, special recipes, &c. This will be ready for circulation as soon as finishing touches can be added to bring it in line exactly with the national policy expounded by the Minister last Friday, and no doubt we shall hear more details at the Dorchester luncheon, which is to be followed by a special meeting for demonstrators from all over the country.

Though the Industry nationally and locally will be most anxious to play a part for which it is so well qualified, it

must be emphasized that to be most effective from the country's point of view the national initiative of the Ministry of Food should be followed, and locally it is to be hoped that efforts everywhere will be based on the civic organization. If local authorities anywhere fail in their duty in this respect, it will be for the Gas Industry and others to endeavour to spur them into suitable activity. The B.C.G.A. have taken a very proper view that the Industry's function is to co-operate, and we trust that everywhere there will be a great local effort with which the individual gas undertaking can co-ordinate its plans and to which it can give the utmost possible support. Our Food To-day is a vital battlefront.

War and Production Costs

In last week's "Journal" we published a report by Mr. James Jamieson, which has been approved by the Edinburgh Gas Committee. This report set out clearly the position of the Department at the end of approximately six months of war and showed clearly, too, the incidence of war on production costs, which has made necessary an increase in the price of gas of 20%. Even so, Edinburgh gas is, at the new rate of 3s. 4d. per 1,000 cu.ft. for the first 5,000 cu.ft. per quarter, with substantial reduction for the amount consumed in excess of this quantity, a low-priced commodity. Actually gas has been supplied below the pre-1914 level of prices, although the cost of coal is 100% more than in 1914. Present gas rates were fixed in 1934-35. On the basis of a normal year's output the increased charges would have the effect of increasing costs by about £160,000 compared with 1934-35. The comparison between conditions as they are to-day and those which obtained five years ago is interesting, and Edinburgh gas consumers will readily appreciate the necessity for raising the price of gas. The cost of coal has risen by 40%, of gas oil 85%, appliances and materials by 25%, and labour by 20%. Income-tax shows an increase of 36%, and, of course, there is the cost of air raid precautions.

Before the war, cost of labour and raw materials had increased substantially, and it says a great deal for the administration and efficient working of the Department that the price of gas was not raised. Since the outbreak of war the output of the Department has been reduced by 15%, and it is likely that it will be stabilized round about that figure. This reduction is due to the loss in street and public lighting, which represented 8% of the pre-war output, and to evacuation. The current year's deficit may be in the region of £30,000, and the increase in the price of gas which has now been decided upon is barely sufficient to wipe out the deficit in a reasonable time having regard to possible further increases in costs. Consequently it has been decided to make a departure from the policy pursued by the Department since 1912 of supplying cooking appliances on free loan. However, the rental to be charged is nominal—1s. per quarter. It will ensure that no appliances are retained by consumers unnecessarily and will make the maximum number available to consumers who need them but cannot afford to buy cookers of their own.

The effect of the changes on the consumer's purse will not be drastic. The increase in the gas bill of the average household consumer will be only about 2d. a week, or 3d. a week when the cooker is supplied by the Department. Moreover, as we have pointed out, Edinburgh gas at the new price is uncommonly cheap, and consolation is to be had, if such is needed, in the final paragraph of Mr. Jamieson's report, in which the hope is expressed that the proposals will permit of the price of gas being held stable for at least a year. It will, we think, be generally agreed that the admirably clear report is a model of its kind and presents a telling picture of the incidence of the first six months of war on the cost of supplying gas in Scotland's capital.

Gas Supply in 1938

The war, which governs the whole of our lives at the present time, must be advanced as the reason for our not having found before this an opportunity to refer to the Gas Manufacture and Supply Statistics for the year 1938 relating to all authorized gas undertakings in Great Britain, which are contained in Part I of the Board of Trade Return. This was issued some time back by H.M. Stationery Office, York House, Kingsway, W.C.2, at the price of 4s. 6d. net (postage extra), and it deals with 703 undertakings, which is three less than the number included in the Return for 1937. This diminution in the number of undertakings dealt with is, of course, a continuation of a tendency which has been noticeable for a good many years past—that is, for the number of undertakings included to diminish. The reduction since 1920 has been practically a hundred—from 798 to the present figure of 703.

Additions to the Return number four—Ashby-de-la-Zouch, March, Sudbury, and Whitstable. On the other hand, no fewer than seven undertakings were absorbed—Barnsley, Chorley, Hayling Island, Newport Pagnell, Quorndon and Mountsorrel, Sandown, and South Shields. The following undertakings were transferred under the County of York, 1938, Order, but remain as separate undertakings: Haworth undertaking to Keighley Corporation; Honley undertaking and Thurstonland and Farnley Tyas undertaking to Holmfirth Urban District Council. In addition to these changes, nearly a dozen amalgamations took place during 1938, but particulars relating to these undertakings are contained in the Return for the portion of that year up to the date of amalgamation. The undertakings thus absorbed are: Blackrod, Blaenavon, Brockenhurst, Denton, Dukinfield, Frodsham, Long Melford, Newcastle-under-Lyme Rural District Council, Radcliffe and Little Lever Joint Gas Board, Rainford, and Southgate.

The usual comparative table accompanies the Return, and from this it is seen that the quantity of gas made (including gas bought from coke ovens) during 1938 was 2,108 million cu.ft. less than the total for 1937; the drop being from 341,985 millions to 339,877 millions. Though, in our present disturbed condition, it may be easy to overlook the fact, 1938 was actually a difficult year, and, in all the circumstances which a little reflection will recall, so small a reduction will be regarded by most people as not unsatisfactory. The quantity sold decreased by a trifle more than the figure just mentioned, that is to say, by 2,197 million cu.ft., but, even so, the figure amounts to no more than 0.69%. Thus the total quantity of gas sold during 1938 was 314,203 million cu.ft., this including gas supplied separately for industrial purposes only.

There were six undertakings which supplied gas separately for industrial purposes only through a separate main, but about two-thirds of the quantity so supplied was furnished by the South Staffordshire Mond Gas Company. The other undertakings concerned in making up the total of 7,708,187,000 cu.ft. were (in the order of the quantity of gas supplied) the Swinton and Mexborough Gas Board, Sheffield Gas Company, Rotherham Corporation, Chesterfield Corporation, and Wombwell Urban District Council. The figure of 7,708 millions in the Return under review compares with 8,037 millions in 1937, and accounts for some portion of the slight falling off in total gas sales already mentioned. It also emphasizes the fact that 1938 was not at all a good business year.

More Coke Oven Gas

No one will be surprised to find that the use of coke oven gas by the authorized undertakings continues to grow. The quantity of gas bought from owners of coke ovens during 1938 and distributed by authorized gas undertakings was 29,621 million cu.ft., or 1,593 millions more than in the preceding year. This represents the substantial increase of 5.6%.

The number of purchasing undertakings was the same as in the previous years—that is to say, 45—but the increase in eighteen years had been from 14 to the present total. The biggest users were the Sheffield Gas Company, the Newcastle-upon-Tyne and Gateshead Gas Company, the Stoke-on-Trent Corporation, and the Derby Gas Light and Coke Company.

This increase in the quantity of gas bought from owners of coke ovens, of course, affects to some extent the gas production figures of the authorized undertakings in relation to the percentage falling off in total gas sales. Thus we see, on referring again to the figures in the comparative table, that during 1938 a decrease occurred in the quantity of coal gas made of 2,970 million cu.ft., or 1.06%; while the quantity of water gas made decreased by 106 million cu.ft., or 0.38%. The totals are: Gas from carbonization of coal, 276,484 millions; water gas in separate generators, 27,253 millions. The amount of coal carbonized was 181,000 tons less than in 1937. On the other hand, 5,000 tons more coke, but 185,000 gallons less oil, were used in the manufacture of water gas. With the reduction in the quantity of coal carbonized, the amount of coke and breeze made decreased by 75,000 tons, but the quantity of tar made increased by 337,000 gallons. With regard to sulphate of ammonia, 1,549 tons more were produced.

Still More Consumers

So much for the statistics relating to manufacture. While they reflect the conditions of a year which was generally unsatisfactory from an industrial point of view, they contain nothing that need depress the Gas Industry in particular. Figures such as these, when times are more propitious, will no doubt be an incentive to still greater effort towards that most desirable of goals—increase of consumption per consumer. And other lessons may be drawn from them, perhaps. But, at least, no one will deny that the Gas Industry was in as good a position as others to weather the storm that, even in 1938, was "brewing," and which has since burst upon the country.

In one respect, at any rate, the 1938 Return contains positive ground for congratulation. During the year the number of gas consumers increased by 205,359, or 1.86%. This increase does seem to confirm the impression that such falling-off in total consumption as occurred was due to less busy industrial conditions prevailing throughout the country. But though the gain in number of consumers may be particularly gratifying as a "relief" to the trifling diminution in consumption figures, it certainly appears to stress the desirability of incessant effort towards a higher consumption per consumer. Business conditions must fluctuate, and with these fluctuations there must be variations in the industrial consumption. That extra appliance on the premises of each domestic consumer would cause these regular additions to the number of consumers to make a greater mark on total sales. At the end of 1938 there were nearly eleven-and-a-quarter million consumers. To be precise, 11,215,104. This total has been reached, by annual steps, from 7,448,332 in 1920. Over this period the gains have been fairly regular, but the incidence has changed, through the ever-growing popularity of the prepayment meter. Since 1920 the number of prepayment meter users has nearly doubled, until by 1938 it had reached almost twice the number of ordinary consumers. There were in 1920 4,030,647 prepayment and 3,417,685 ordinary consumers; and in 1938, 7,248,829 prepayment and 3,966,275 ordinary.

During 1938 something like 2,000 miles was added to the total length of mains required for the supply of the 11,215,104 consumers, bringing the total length to 65,459 miles.

Though public lighting has since suffered so drastically, it is still interesting to record that 1938 witnessed a substantial increase in the quantity of gas sold to local authorities for that purpose—the total being 14,973 million cu.ft., which compares with 14,482 millions in 1937, and 13,907 millions in 1936. The increase in gas used for public lighting from 6,928 million cu.ft. in 1920 to the total just quoted is an achievement in which the Gas Industry is fairly entitled to take pride. Before leaving the Return, one other figure may be quoted which is frequently asked for. The total quantity of coal carbonized by the Gas Industry in 1938 was 18,469,000 tons. Coke used for water gas and producer gas was 535,000 tons, while oil for carburetting totalled 32,707,000 gallons.

An Industrial Gas Discussion Group

Much interest will be attached to a new step which has just been taken at Burnley, details of which are given on another page of this week's "JOURNAL." Briefly, it consists in the formation of a small Industrial Gas Discussion Group whose membership will be drawn from various adjacent undertakings in north-east Lancashire and whose purpose will be to pool and discuss any problems which may arise in connexion with the increasing use of gas for industrial purposes in this important area. At future meetings, which are to be held once a month in the Burnley Gas Showrooms under the Chairmanship of Mr. S. Atkinson, it is intended that short papers shall be read and discussed, along with problems with which members may come into daily contact. The originator of this excellent scheme has modestly shielded himself behind a cloak of anonymity; but if, as we suspect from the source of the information, the credit is due to Mr. A. F. Ames, Engineer and Manager of the Burnley Gas Department, he—or whoever else may be responsible—is to be commended for an idea which should prove of very considerable benefit to all concerned in the promotion of industrial gas sales in the district. In these days of intense activity in the industrial business it is an idea which many other groups of contiguous undertakings might find it helpful to copy.

Coke Research in the Midlands

We have received from Dr. R. A. Mott, Secretary of the Midland Coke Research Committee, a copy of the Committee's Progress Report for 1939. Since the formation of the Committee in 1926 much excellent work has been accomplished. As a result a great deal has been added to our knowledge of the properties and qualities of coke, standardized methods have been evolved of assessing its properties, and means of improving its qualities have been determined. The properties of coke in regard to its use in blast furnaces and for other metallurgical purposes have been the main concern, but the use of coke for domestic purposes and for other special purposes is now also receiving attention. The work on the production of reactive coke is making satisfactory progress and can be applied to the problem of the preparation of fuel for mobile gas producers.

In regard to the production of open-grate coke in coke ovens, a large-scale test has been made carbonizing in a coke oven a mixture of uncrushed treble, double, and single nuts of a coal of relatively low rank. Sodium carbonate to the extent of 0.5% and 1% of ground limestone were added as a powder to the slightly wet surfaces of the nut coals. The activation by alkali was successful and the coke produced was of suitable physical quality for domestic purposes. Again, by heating a non-coking coal of low rank at a fast rate in the experimental oven the yield of breeze was reduced to 10% and the coke, though not of metallurgical quality, was, it is stated, an "excellent domestic fuel for open grates."

One research which has been advanced sufficiently to draw general conclusions is the effect of durain in coking coals on the quality of coke. It has been shown that whatever the rank of the coal the impact hardness (shatter index) of coké is improved with the presence of up to 50% durain in hards (finely crushed) but that larger percentages have an adverse effect on the abradability of coke. Although the effect on the abradability may be considerable for coals of very low rank when less than 50% of durain is present, the results show that the hard coals of Nottinghamshire and Derbyshire, at present considered unsuitable for coke-making, could be used with advantage in admixture with coals of higher rank. The results also show that the commonly high content of durain in Yorkshire coking slacks is one reason why a better coke is made from such coals than from Staffordshire coals of the same rank which are usually of lower durain content.

Personal

Mr. DANIEL MARSHALL, of Perth, has been appointed Gas Engineer and Manager by the Burntisland Town Council. The vacancy has been created through the retirement of Mr. William Brown.

* * *

Mr. W. E. YOUNG, Manager and Secretary of the Queenstown Gas Company, has retired after forty years service. At the monthly meeting of Queenstown Urban Council high tribute was paid to Mr. Young's work.

* * *

Mr. JOHN GILES, Manager of the Sandwich Gas Department, who is retiring after 35 years' service with the Undertaking, recently received two presentations. The first, an armchair and illuminated address, was given by the staff of the works, and the second, a travelling rug, by fellow officials.

* * *

Mr. A. L. HOLTON, Chief Engineer of the Manchester Gas Department will attain his 65th birthday on Dec. 26 next and under the Superannuation Act, his services would normally terminate on this date. Having regard to the conditions created by the war, however, it was decided by the Gas Committee to retain the services of Mr. Holton for a period of twelve months after Dec. 26, or in the event of a cessation of hostilities, for a period of six months afterwards, whichever be the earlier.

* * *

At the recent Annual Meeting of the Luton Gas Company, the Chairman, Mr. R. E. Tomson, mentioned an extension to the fourth generation of the link between the Phillips family and the Company. Mr. WILLIAM PHILLIPS, General Manager, Engineer, and Secretary, now in his 51st year of service, succeeded his father, William Richard, who had held the office since 1889. He, in turn, had followed another William Phillips, who had been appointed Superintendent of the Gas-Works in 1843.

Since the end of last year, Mr. W. G. PHILLIPS has been Personal Assistant on the staff to his father. Before his appointment to Luton, Mr. W. G. Phillips, who has a Cambridge engineering degree, was three years with the Croydon Gas Company, having previously had practical training at the Worthington-Simpson Company engineering works at Newark.

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Mr. L. C. H. ATHILL has relinquished his position as London Manager of the Parkinson Stove Co., Ltd., and ceased to represent the Company on March 31. With a view to maintaining their service, the Board have appointed the Commercial Manager, Mr. E. M. KETTERINGHAM, to represent the firm's interests in the London area.

Obituary

P. D. Walmsley

His many friends in the Industry will learn with regret of the death of Mr. P. D. WALMSLEY, for more than twenty years chief executive officer of the Great Yarmouth Gas Company and Managing Director since 1931.

Mr. Walmsley commenced his career in the Gas Industry with five years in the offices and works of the Tyldesley Urban District Council Gas and Water Department. This was followed by three years at Owens College, Manchester (Victoria University), where he specialized in mathematics and engineering. He obtained the College Certificate, First-Class with Honours, in these two subjects and also B.Sc. Honours Degree in engineering. For twelve months he was in the drawing office of Messrs. R. & J. Dempster, of Manchester, after which, for three-and-a-half years he was Assistant to Mr. George Helps at Nuneaton. From 1908 to 1919 Mr. Walmsley was Gas and Water Engineer to the Wombwell Urban District Council. In 1919 he was appointed Engineer and General Manager to the Great Yarmouth Gas Company and in January, 1931, was given a seat on the Board with the position of Managing Director.

An Appreciation

The tragic and untimely death of P. D. Walmsley, B.Sc., Engineer and Managing Director of the Great Yarmouth Gas Company for a number of years, will be a severe shock to his wide circle of friends in the Gas Industry.

A mere account of his career can give no real impression of his quite exceptional personality. The combination of a great moral courage and a first-class brain developed by training and an association from his early days onward with others of the same calibre, often passed unnoticed owing to the charm of manner and modesty to which they were allied, but when the question of principle was involved he was perfectly inflexible. He will be remembered by what he did, but much more by what he was. The personal esteem in which he was held by all his friends and those who served him, for he was an ideal master, extended throughout the many activities of his life.

In attempting a picture it would be wrong to paint it in too sombre colours, for he enjoyed all the intellectual and material good things of this life. His strong affections in his own family circle and among his host of friends in the Gas Industry, his wit, charm of manner, no less his expert knowledge, zeal and initiative contributed largely to the measure of success he achieved in almost everything he attempted.

The sympathy of his friends drawn from many business associates and acquaintances will go out to his wife deprived of his affection and support after their years of true companionship, and to his daughter and son upon whose career he lavished such care.

The Industry has reason to deplore his loss.

F. E. M.

Letters to the Editor

Ice in Gasholder Tanks

SIR,—I observe that Dr. Foxwell is not quite clear as to what takes place when water in a gasholder tank commences to freeze, and in view of the interest that is being taken in this matter I propose to deal with this question in some detail. It is immaterial whether a gasholder tank is made of steel, brick, or concrete, or whether it is above, partly above, or entirely below ground; the fact remains that the water in the tank will always commence to freeze at the top surface. The reason for this is really quite simple and may be illustrated in several ways. Hope's experiment, to which I have previously referred in my correspondence with Mr. Toogood, shows conclusively that ice will form at the top surface of water contained in a vessel, even though the greatest fall in temperature is on the side of the vessel. The experiment may be described as follows: A metal vessel having an outside trough and fitted with two thermometers, as shown in Fig. 1, is filled with cold water.

A freezing mixture of broken ice and salt is placed in the trough and the temperature of the water at the top and bottom of the vessel as indicated by the two thermometers is recorded periodically. As cooling of the water in the vessel proceeds it will eventually be found that the lower thermometer shows that the water in the bottom of the vessel has fallen to a temperature of 4° C. From this time onwards the cooling below 4° C. of the water near the middle of the vessel results in an increase in volume and consequently, a decrease in density. This decrease in density causes the colder water to rise to the top of the vessel. This movement of the water is indicated by the fall in temperature recorded by the upper thermometer. The temperature of water at the top of the vessel then gradually falls to 0° C. and then freezes, forming a layer of ice at the top surface of the water. The temperature recorded by the lower thermometer will be found to remain at or near 4° C. for some time after the formation of ice at the top of the vessel. Further demonstrations of this well-

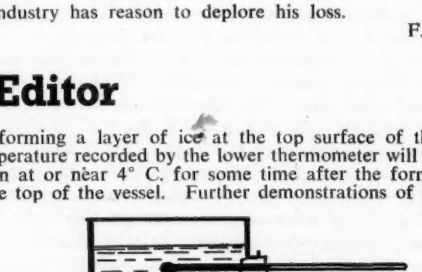


Fig. 1

known phenomenon are to be found in buckets and small iron tanks subject to frost. Ice will always be found to have formed first at the top surface of the water in such vessels, while the

sides will be free. If observation is made during frosty weather on holders in which no form of anti-freezing apparatus has been fitted, it will be found on removing the ice from the surface of the water in the tank that no ice has formed on the inside of the tank such as is suggested by Dr. Foxwell's theory of fluid flow.

When Dr. Foxwell writes "My solution is the standard one, properly applied—namely, anti-freezers"—I naturally took his remarks to refer to the standard form of anti-freezing apparatus and not necessarily to chemical treatment of the tank water, and I am looking forward to Dr. Foxwell's further explanation of the particular treatment he has in mind which has prevented ice formation in all the instances of which he has knowledge.

In the last paragraph of Dr. Foxwell's letter he mentions that keeping the tank water from freezing is a chemical engineering problem. The chemical treatment of water to prevent freezing is not new.

I am pleased to see that Dr. Foxwell admits in effect that no pump would be necessary if the circulating boiler is in the position I have shown in Fig. 1 of my article, as he now asks how deeply the boiler house must be excavated, and he also wishes to know how the boiler house can be kept from flooding in wet or snowy weather. I do not see any insurmountable difficulty in accomplishing this.

Will Dr. Foxwell explain how the outlet pipe from the tank to the boiler is liable to become broken if not due to freezing?

I observe that Dr. Foxwell contends that the calorific value of the gas is not reduced with heavy steaming, and on this point we must agree to differ.

Much as one might wish to see the use of condensers develop on gas-works, I am afraid Dr. Foxwell's suggestion to fix condensers on the outlets of gasholders will not materialize.

Although Dr. Foxwell intimates in the second line of his last paragraph that he is speaking for *all chemical engineers* with regard to the question of heat transference, I doubt whether some of them would hold with his theory of ice formation.

Yours, &c.,

S. M. MILBOURNE.

"Amherst,"
New Church Road,
Wellington, Shropshire.
April 6, 1940.

SIR,—Mr. Milbourne's article in the "JOURNAL" of Feb. 28, and the discussion which has followed, have proved of interest to me in view of the severe weather experienced this winter.

Mr. Milbourne is correct in stating that "the coolest water in the tank rises to the surface, owing to the fact that when the temperature approaches freezing point, the density of the water decreases." The density of water at 0° C. is 0.999867, whereas at 4° C. it is 1.000000. The density of ice varies between 0.9159 and 0.9182 according to the mode of formation.

The gas passing into storage, however, is above freezing point and forms an effective blanket for the surface, so that the cooling in a tank above ground mainly takes place through the action of weather on the side sheeting of the tank. Under these conditions ice forms on the sides as well as the surface as mentioned by Mr. Toogood in his letter of March 2. I must agree with Dr. Foxwell's remarks on the inefficiency of heating the gas to prevent freezing of tank water, since the area of the water surface exposed to the gas will be πr^2, while the area of holder surface exposed to atmosphere will be $2\pi rh + \pi r^2$; thus, with the holder fully inflated about five times as much surface is available for heat dissipation from gas to atmosphere as for heat transfer from gas to water. Besides, the specific heat of gas at ordinary temperatures is roughly between 0.31 to 0.32 calories per cubic metre, while that of water is 1.00 calories per gramme, or 1 million calories per cubic metre.

Mr. Milbourne's repeated assertion that the admission of live steam reduces the calorific value of the gas is erroneous. The gas is fully saturated with water vapour at the temperature of storage, and if the heating causes expansion and raises the saturation point surely the gas will have regained its normal temperature and saturation by the time it reaches the consumers' meters? In view of this I find the carefully compiled table of steam pressures and jet sizes particularly interesting.

With regard to "Method (b)" for heating the tank water, might I suggest that if the cold water pipe to boiler came off, say, 12 in. to 18 in. below the water level on one side of the tank and the warmed water was delivered at surface height diametrically opposite, the object would be achieved with the following disadvantages to the original system:

(1) Warming all the water in the tank.

(2) Passing the heated water from base to surface through a pipe surrounded by cold water.

(3) Accidental damage to pipes would not have the serious effects visualized by Dr. Foxwell.

Finally, may I suggest that since atmospheric cooling of above ground tanks takes place mainly through the tank sides, a good plan is to keep the outer lift grounded during severe weather. The water in the annular space between tank and outer lift is kept separate from the main body and acts as an insulator. Water is a poor conductor of heat, and convection has been prevented so the remaining water will suffer only a small temperature drop, and with the assistance of the normal anti-freezers no trouble should be experienced.

Yours, &c.,

JOHN SMITH.

Gas-Works,
Hinckley.
April 2, 1940.

SIR,—It was so like the Author of the article to ignore in his reply ("JOURNAL" for March 13, page 577) my examples-of-fact, refer me to a text book, and then, filled with self-righteousness at having said very little or next to nothing, conclude with the benediction, "that therefore his paper was based on a correct premise." If I may say so, it rather reminded me of the howler of a schoolboy, who on being asked by his teacher, "What is the opposite of Ladies?," replied "Exit!" thus showing that the boy had one grievous fault, he attached too much importance to the printed word.

However, at no little trouble, I obtained a copy of the aforesaid text book, and carefully digested "Hope's Experiment," and was absolutely astounded to find that "Hope's Experiment" dealt solely with the changing densities of cooling water, there being not a shadow of evidence that Hope, in his experiment, produced ice-formation (the subject under discussion) at all. Hence, from the mouth of Hamlet

> *"Let it work.*
> *For 'tis the sport, to have the engineer*
> *Hoist with his own petard."*

as surely, the Author, by referring me to "Hope's Experiment" is so "Hoist with his own petard," for his fault lies barefaced, as is his unwarranted liberty of reading into the experiment that which is not there. Ice at its best is but a slippery subject, and on paper it apparently loses none of its elusiveness; hence this widespread and erroneous belief, held also in high places, and taught in our schools even to this day (that Nature sends the coldest water to the surface immediately before freezing, *so that water commences to freeze at the surface*), is an entire fallacy, born, I suggest, of ancient folklore, of Nature's kindness to little fishes.

In my previous letter ("JOURNAL" for March 6, page 513), I asked: "Is not the statement of the Author in this article based on a wrong premise?," and I gave examples-of-fact which showed clearly that water-cooling and ice-formation are two independent processes, widely separated by yet a third process—the extraction of the relatively huge quantity of latent heat of water, without change of temperature, and all three processes proceed independently and simultaneously in different portions of the same body of water, regardless of the name of the vessel which contains the water, be it gasholder or fishpond, and ice forms wherever the water becomes sufficiently cold, both qualitatively and quantitatively.

Therefore, I am now enabled to state definitely that the Author's statement in his article *is* based on a wrong premise.

Yours, &c.,

H. J. TOOGOOD.

43, Uxbridge Road,
Hampton, Middlesex.
April 5, 1940.

Modern Gas Storage

SIR,—The writer of the letter signed S. Langford, which appeared in your issue of March 27, is apparently so displeased with my criticism of Mr. S. C. Thomson's Paper on "Modern Gas Storage" that his feelings have caused him to forget the usual courtesy of business controversy and describe my remarks as a "diatribe" and my motives as something of a very cryptic kind. The basis of these fallacious allegations seems to be that Mr. Thomson's Paper had a sub-title referring to M.A.N. waterless gasholders, but reference to the published report in the "GAS JOURNAL" of March 6, to which my criticisms referred, does not bring any enlightenment on this point, and so far as I am concerned, the matter is closed.

I do, however, appreciate Mr. Langford's frank admission that the largest waterless gasholder erected in the world up to the present is one of the Klönne design. In regard to waterless gasholders generally, it is now over twenty years since their introduction, and the suitability of the different types for various purposes, has been sufficiently proved and tested to assure them a permanent place in modern gas storage, especially for the crude gases from coke ovens and blast furnaces.

Yours, &c.,

R. J. MILBOURNE.

Wellington,
Shropshire.
April 2, 1940.

News of the Week

Copies of the Following recently issued British Standard Specification can be obtained, on application, to the Secretary of The Institution of Gas Engineers, 1, Grosvenor Place, S.W.1, price 2s. each: No. 888-1940 slip (or block) gauges and their accessories.

The Output of Gas at Oldham for the last financial year showed a reduction of about 1½%, according to a report by Mr. E. Parry, Commercial Manager of the Corporation Gas Department, at the monthly meeting of the Committee. Had it not been for the cutting off of street lighting through the war, the Department would have shown a fairly substantial increase.

Early this Year we published information that the Whessoe Foundry & Engineering Company, Ltd., of Darlington, were standardizing selenium rectifiers for the h.t. equipment of their "W. W-D." electro-detarrers. We now hear from the Whessoe Company that they have ordered ten such static rectifier equipments for Electro-Detarrers in hand.

It Has Been Agreed by the Motherwell and Wishaw Town Council to accept the offer of Alexander Anderson & Sons, Ltd., Carfin Boiler Works, amounting to £2,310, an increase of 5% on their original offer, for the installation of a new boiler at the gas-works. It was intimated that the Scottish Home Department had consented to the Town Council's borrowing £3,000 in connexion with the installation of the boiler. The Secretary of State for Scotland has refused to sanction the borrowing by the Town Council of a total of £35,000 to provide for expenditure in connexion with the proposed augmentation of plant at the gas-works. The Gas Committee had recommended that the retorts be renewed, that the exhauster plant be extended, that the scrubbers be augmented, and that a benzole recovery plant, with accessories, be installed.

The Directors of the Oriental Gas Company have decided to pay on May 31 an interim dividend of 3½%, less income-tax, on account of the year ending June 30 next.

In a Year which brought many difficulties to the paint trade Pinchin, Johnson, & Co. succeeded in achieving increased earnings. Net profit rose from £303,882 to £355,547, and as the 1938 figure included a non-recurring item of £16,792, the real increase was £68,456.

A Return to London from their temporary offices at Surbiton is announced by Gibbons Bros., Ltd. As from April 8, the firm's London Offices will be re-opened at 151-154, Palace Chambers, S.W.1. (Telephone: Whitehall 6417-8; telegrams: "Giboyant, London.")

The Installation of modified street lighting in the district in readiness for next winter is to be considered by the Blaby Parish Council. The Narborough, Blaby, Enderby, and Whetstone Gas Light and Coke Company are to erect a specimen lamp so that members of the Council may inspect it and decide the question at their next meeting.

A New Patent (No. 518,201; application date Sept. 23, 1938) relates to ignition devices of the type having a length of flexible tubing attached to a gas valve carrying a pyrophoric lighter together with a nipple giving a short flame when alight. This patent, which has been granted to A. Watson, claims that by the construction of the device greater safety is secured in the "off" position combined with ease of manipulation. The improvement is obtained in the first place by utilizing a spring return valve instead of the customary taper gas tap and by the provision of a sparking device which is actuated by the action of withdrawing the jet to be ignited.

Women's Gas Council

A Busy Month

Demonstrators' Conference

The London and Home Counties Demonstrators' Circle have invited Demonstrators from all over the country to a Conference on Saturday, April 13. If any demonstrators who will be in London for meetings on Friday, April 12, are able to stay on for this Conference, Miss E. Willins, M.B.E., Chairman of the Circle, will be Chairman at the Conference and act as hostess.

The programme begins on Friday evening when delegates are invited to a buffet supper at 1, Grosvenor Place, to be followed by discussion and entertainment. On Saturday, April 13, at 10 a.m., Miss M. P. E. Pearson, Dietist to the Gas Light and Coke Company's Home Service Department, will speak on "Food and Fitness in Wartime."

The organizers of the Conference have been fortunate enough to get Miss G. S. Summers, H.M.I. Board of Education, to speak, and at 11.30 a.m. she will tell the delegates about "Food Education in Wartime." Miss Summers has been working on wartime food problems both at the Ministry of Food and at the Board of Education since the beginning of the war, and is in a position to give her audience valuable practical suggestions to help them in planning out their work for the Food Education Campaign.

After lunch at 1, Grosvenor Place, there will be an open session from 2.15 to 3.30 p.m. when delegates will discuss the points raised in the speeches and plans for their own co-operation in the work of educating the housewife to make the best use of food supplies in wartime.

The conference fee is 5s., including meals. Already over thirty applications have been received from demonstrators who wish to attend, and more are coming into the office every day.

Annual General Meeting

On Tuesday, April 23, the Annual General Meeting of the Women's Gas Council is being held at 1, Grosvenor Place; Mrs. Warren Pearl will take the Chair. A speech will be given by Mr. R. Austin Pilkington, J.P., Joint Hon. Treasurer of the Y.M.C.A. War Service Fund and Hon. Treasurer of the National Council of the Young Men's Christian Associations, on the "Work of the Y.M.C.A. in Wartime."

Presentation of Mobile Canteen

After the business meeting Lady Milne-Watson, Hon. Treasurer of the Women's Gas Council Mobile Canteen Fund, will present the canteen to Mr. Pilkington on behalf of the members of the Women's Gas Council.

The canteen van will be on view outside 1, Grosvenor Place, during the afternoon. Tea will be served after the ceremony.

"Fanfare"

The Spring issue of *Fanfare*, the quarterly magazine of the Women's Gas Council, appears this month. This number includes, among other things, an interesting article by Miss Mabel Blackmore giving the history of the manufacture of margarine, an article on bee-keeping by Mrs. I. Bray, and economical recipes tested by members of the Burnley Branch of the Women's Gas Council.

Making a Mock of It

This month's leaflet in the series "I Pass This On To You" deals with vegetarian recipes under the title "Making a Mock of It." All these recipes are tested by experts and tried out by amateur cooks before they are published in these leaflets.

The second leaflet of the series has been popular. Three large reprints were necessary. There was some delay in obtaining the third of these, because the printers reported that they had used up all the store of paper bought in for eight leaflets of the series on the first two.

Industrial Gas Discussion Group

Formed at Burnley

In view of the increasing sale of gas for industrial purposes, it has been considered that it will be beneficial to form a small Industrial Gas Discussion Group, consisting of interested members of adjacent Undertakings, to pool information and discuss any problems which may arise.

A preliminary meeting was therefore held in the Burnley Gas Showrooms on Wednesday evening, April 3, attended by the following representatives:

Messrs. Atkinson, Pegg, and Shackleton (Burnley).
Mr. A. Harrison, Junr. (Deputy Engineer and Manager), and Mr. Clegg (Accrington).
Mr. J. W. Roberts (Engineer and Manager, Padiham).
Messrs. Bennett and Whitehead (Colne).
Mr. Stanley (Nelson).
Mr. Epgrave (Barnoldswick).
Mr. Carter (Rossendale).
Mr. Langstreth (Deputy Engineer and Manager, Todmorden).

It was agreed that subsequent meetings be held the first week in each month in the Burnley Showrooms, under the Chairmanship of Mr. S. Atkinson, Showroom Manager, Burnley, with Mr. A. Harrison, Junr. (Accrington) as Vice-Chairman.

At future meetings, it is intended that short papers shall be read and discussed, along with problems with which members come in contact daily.

It is felt that this joint effort of the Gas Undertakings in North-East Lancashire will be very helpful and serve a useful purpose in developing the demands for gas for industrial purposes.

Gas Retort Settings

Design for Increased Heating Efficiency

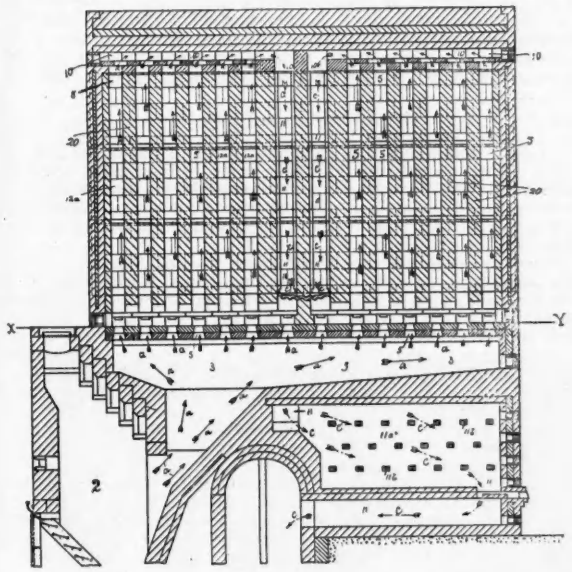
A patent (No. 518,121; application date June 15, 1938) has been taken out by Drakes, Ltd., and M. Thompson relating to improvements in the heating arrangements of retort settings. The object of the invention is so to arrange the retorts, the producer, and the flues for the gas, waste gases, and secondary air that their efficiency as well as their economy in the utilization of the heat of the waste gases is such that the latter when withdrawn from the setting have greatly increased heat.

The invention consists in a coal gas chamber retort setting, the retorts being arranged in tiers and supported by transverse walls which form vertical flues along which combustion takes place in contact with the vertical sides of the retorts. The waste gases pass along horizontal flues to the middle of the setting where they descend to impart heat to the inflowing secondary air before they are withdrawn from the setting still in a highly heated condition.

The producer is situated at one end of the setting in the usual manner, but with the flues leading therefrom conducting the gases rearwardly beneath the setting and with openings leading therefrom to combustion chambers.

Fig. 1 is a longitudinal section of the retorts and their setting, made centrally therethrough.

The producer 2 is positioned below the ground level X Y (and partly within the setting) so that the gas therefrom may be conducted as indicated by the arrows *a* into a mixing chamber 3 beneath the setting and on each side of the furnace in order that from each of the chambers the producer gas is fed into two other chambers into which secondary air is conveyed by the flues 5. The secondary air enters through orifices to mix with the producer gas, and the products of said combustion rise therefrom in two streams to contact entirely with the outer side surfaces of the two



sets of retorts placed in positions with passages 12*a* along their inner sides, both streams meeting at the upper ends, and passing through orifices to mingle with each other and enter the longitudinal flues 10 at the top of the setting and travel along it to the central position, from which the gases descend along the passages 11.

The outflowing streams of waste gases then enter chambers 11*a* (all beneath the setting) having baffle members 11*b*. The chambers, which are four in number, are arranged adjacent to four flues 5 for the inlet and conveyance of the secondary air, which is heated to the temperature required and passes from the flues 5 to the combustion chamber.

The flues 5 along which the secondary air travels are four in number (for the two sets of retorts) and are arranged two in the centre of the setting and two near the outer walls of the setting. The air inlets to the flues are controlled by dampers.

The flues 5 are arranged to conduct the air in a sinuous path while adjacent to the chambers 11*a*, and for this purpose the parallel lengths of the flue are connected alternately at one end and the other.

The transverse walls 20 support the retorts and also form two sides of the flues (12*a*) the other two sides being formed one by the longitudinal walls of the setting and the other by the vertical side walls of the retorts.

The flat sides of the retorts become heated by the hot gases in the flues, and the comparatively narrow strip of coal therein is carbonized evenly throughout its whole length and width.

The combustible gases, state the patentees, are found to act upon the coal through its whole thickness, one side being evenly treated the same as on the other, in this manner producing a finer quality of benzole, which result is another factor of the improvement claimed.

The combustion chamber temperature of the setting is approximately 1,350° C. and the temperature of the waste gases as they pass into the main flue is approximately 1,150° C. With an efficient waste heat boiler this gas is capable of raising 4 lb. of steam for every lb. of fuel put into the producer.

In view of the fact that the works steam requirements will, to a considerable extent, be met by the steam produced from waste heat of setting, there will be available a quantity of small coke. The patentees have, therefore, made provision in the producer for the consumption of the small coke made from the plant.

Flambeau—Spring, 1940

The B.C.G.A. are to be congratulated upon the quality which they have succeeded in maintaining in this publication in spite of war difficulties, and the Spring number once again provides gas undertakings with well disguised gas propaganda for distribution to discriminating consumers.

Six famous people contribute wartime recipes. Their tastes are interesting. For example, so eminent an actor as John Gielgud is specially interested in eating up left-over meat, while the High Commissioner for South Africa calls for two tablespoonsful of sugar when he curries a nice fleshy fish. When the sugar ration is running low, he quite happily substitutes apricot, plum, or greengage jam; but for those of us who have not quite such epicurean palates Mabel Constanduros provides something plainer in a recipe for vegetable pie.

However, only the first two pages of the spring issue are devoted to recipes. Other pages contain articles and hints on a variety of subjects. Sir Leonard Hill, the famous scientist, gives a talk on food and health. There is useful advice on "Digging for Victory" by the Secretary of the National Allotments Society, and throughout the issue there are practical hints on wartime problems, and sound advice on economy and the elimination of waste in the home. On the lighter side, Brian Hill, in an interview with Tommy Handley, succeeds in securing (not until the last line!) a message for *Flambeau* readers from one of our brightest radio and music hall stars.

One of the chief points about *Flambeau* has always been the attractive way in which it is produced—well-displayed pages, headings that catch the eye, and above all, perhaps, striking photographs. Every paper has to cut down its illustrations in these days, but a glance at *Flambeau* shows that it is not so much the quantity that counts. The delightfully natural picture on the cover of the two children at play makes one involuntarily pick up the magazine—and one goes on reading.

Forthcoming Engagements

April

11.—S.B.G.I.—Emergency Committee, 56, Victoria Street, S.W.1, 2.30 p.m.

11.—B.C.G.A.—Annual Meeting of members in the Midland District, Grand Hotel, Birmingham, 2.30 p.m.

12.—I.G.E.—Pipes Committee, 3 p.m.; Gas-Works Safety Rules Committee, 3 p.m. (joint session).

15.—L.C.C.A.—Finance Committee, 10.45 a.m.; Executive Committee, 11.15 a.m.; Central Committee, 2.15 p.m.

15.—B.C.G.A.—Annual Meeting of Members in the South Wales District, Gas Offices, Bute Terrace, Cardiff, 3 p.m.

16.—I.G.E.—Gas Education Executive Committee, 2 p.m.

16.—I.G.E.—Domestic Heating Committee, 2 p.m.

16.—Gas Research Board.—Emergency Panel of Council, 11.30 a.m.

17.—Gas Research Board.—Methane Panel of Joint Committee on Complete Gasification Under Pressure, 2.30 p.m.

17.—Southern Association.—Eastern District Meeting, Gas Industry House, 2.30 p.m.

18.—Midland Coke Association.—Annual General Meeting, Grand Hotel, Birmingham, 2.30 p.m.

19.—I.G.E.—Chairmen's Technical Committee, 2.30 p.m.

20.—Yorkshire Juniors.—Short Paper Meeting.

23.—W.G.C.—Annual General Meeting, Gas Industry House.

24.—I.G.E.—Library Committee, 2.30 p.m.

27.—Manchester and District Juniors.—Meeting at Stretford. Papers by J. C. Hogg on "Carbonizing of Stock Coal," and by H. Q. Marris on "Sales of Appliances in Wartime."

The Testing of Coals Intended for the Carbonizing Industries*

THIS book is a re-print of two lectures given by the Author before the National Conservatoire of Arts and Trades in November, 1938. The lectures would, possibly, correspond with the Cantor Lectures of the Royal Society of Arts. The Author who is the Chief Engineer of the Compagnie Générale de Construction de Fours and is in charge of their laboratories, was recently elected a member of The Institution of Gas Engineers. He has, therefore, a complete mastery of his subject and is able to give a very comprehensive survey of coal-testing methods.

The book opens with a chapter devoted to general considerations on the nature of coal, the dependence of carbonizing results on temperature conditions and a résumé of the test-methods later to be described.

Attention is next devoted to standard size-grades of coal and coke, mechanical strength as determined by abrasion, shatter, and crushing tests, specific gravity, and washability. Reference is also made to the use of a simulative coke oven by means of which the charging density of the coal may be ascertained.

Chapter II deals with the elucidation of the constitution of coal by physical methods, including the use of X-rays, thin sections, fractional distillation, and solvent extraction. The study of the constitution of coal by chemical methods based on hydrogenation and oxidation is next described, and reference is made to methods for the determination of volatile matter, ash fusibility, ultimate analysis, and calorific value, following which the classification of coals is discussed. In connexion with volatile matter, the C.G.C.F. modification of Audibert's method for the continuous determination of the loss of weight of a sample of coal during carbonization is described. For the determination of ash fusibility, Bro's method is indicated. The significant statement is made: "It will be understood that too blind a confidence must not be attached *to the absolute value of the figures* which may be reported by laboratories no matter how distinguished or official the latter may be. Serious disillusionments may result from them. A laboratory should choose the method for which the most precise details have been given and should adhere to it, though it will never obtain *other than relative values.*"

In the Seyler chart given for French coals, curves are shown for the swelling obtained in the C.G.C.F. rate-of-swelling test, a test which is similar in principle to the Sheffield coking test, modifications of which are in general use.

Swelling Tests

Chapter IV is concerned with the physical effects connected with carbonization and discusses thermal conductivity, heat of dissociation and transient fusion. In connexion with the latter, the C.G.C.F. rate-of-swelling test, referred to above, and Foxwell's permeability method are described in addition to the Woodall-Duckham crucible swelling test, which is indicated as having now been adopted as the basis of a British Standard Specification. M. Cassan states that the latter test gives, in effect, nothing beyond the end-point obtained in a rate-of-swelling test and its justification might seem to lie merely in its simplicity. "In reality, the 'W.-D.' method gives such sharp results that if one were reduced to the use of but a single test on a coal for the determination of its aptitude for carbonization, it is this method which would have to be chosen. The British Standards Institution has, moreover, recognized it by adopting this test." Chapter IV deals, also, with the agglutinating index test, which is shown to be of very doubtful value, with the Koppers swelling-pressure test and with box tests.

Chapter V is devoted to assay tests. Descriptions are given of the very elegant C.G.C.F. apparatus which even embodies a tiny electro-detarrer, and of the Geipert and Gray-King methods. The mutual relationships of the oxygen and volatile matter content of the coal and the thermal yield are discussed and illustrated graphically.

The final chapter deals with the combustibility and reactivity of coke and their significance. For the determination of the reactivity of coke, the Author is again able to describe a very elegant apparatus in use in the C.G.C.F. laboratories. The most interesting feature of it is the elaborate arrangement whereby a delicately controlled and known small amount of water is vaporized per minute and passed over the coke.

Rules for the sampling of coal are given in Appendix I. In a second appendix, a method for the determination of methane—the final step in a gas analysis—is described. The method is the well-known one in which the residual gas is burnt with air in a vessel containing a heated spiral of platinum wire. The improved form of combustion vessel designed in the C.G.C.F. laboratories is a feature of the apparatus.

An extensive bibliography completes this very useful book.

* Essais des Houilles destinées aux Industries de la Carbonization. By H. Cassan (Paris 1940, Dunod, Pp. viii+148).

National Smoke Abatement Society

Meeting in Manchester

A MEETING of the Council of the National Smoke Abatement Society was held in the Central Library, Manchester, on Tuesday, April 2, under the Chairmanship of Mr. Charles Gandy, of Manchester.

A short Paper entitled "Smoke Abatement During the War," was presented by Dr. J. Johnstone Jervis, Medical Officer of Health for Leeds, and Hon. Secretary of the West Riding of Yorkshire Regional Smoke Abatement Committee. Owing to Dr. Johnstone Jervis having to attend a medical conference, the Paper was read by Mr. Arnold Marsh, the General Secretary of the Society.

It was stated in the Paper that war created new problems and aggravated others. Among the latter was the abolition of smoke which was the peculiar interest of the Society. A war could be fought to a successful conclusion only if the nation's health was maintained. The effort required to achieve victory would call for the exercise of every ounce of strength from workers as well as fighters; and to stand such a test of endurance every factor adversely affecting health and efficiency, of which smoke was certainly one, should be eliminated. Furthermore, when the war was over and the victory won, an A1 population would be needed to re-build the new Britain and repair the breaches in the national life.

There was no greater or more unjustifiable form of waste than smoke. It represented not only loss of fuel which meant loss of money, but also loss of economic security for the future as well as for the present. We might be entitled to squander our birthright—even that was questionable—but we had no right to squander the birthright of our children.

In the same connexion there should also be a word of warning for householders who weekly consigned to the dustbin a quantity of fuel in the shape of cinders that if collected would keep a blast furnace running for months. The people must be told that the nation could not afford waste of this kind at such a time. By burning cinders, which were a form of smokeless fuel, the amount of smoke emitted from the domestic chimney could be considerably reduced.

Need for a Bold Policy

Unless a bold policy was adopted there was a risk of the Society losing all the benefits that had been gained during many years of hard work. If they were content to do nothing men would forget; by-laws would be ignored, and become a mockery; cities and towns would once more become the abode of perpetual gloom, and many other evils would result.

When the subscribers to the Society realized that an attempt was being made to achieve something really worth while and which would make a valuable contribution to victory, the great probability was that they would all the more readily increase their support and encourage others to join the Society.

The Author of the Paper concluded by expressing a firm conviction that the call of the present crisis was to greater, not less, activity; to a broader, not a narrower exposition of the principles for which the Society stood.

During the course of the discussion which followed, Dr. R. H. Clayton mentioned that if a works was increasing its output by 20% to 25% the strain on the boiler plant would be excessive. As far as he was concerned, he would continue to produce his products and perhaps not pay so much attention to smoke production as he would do if no war conditions prevailed. After all, we were out to win the war. He spoke as one who had been interested in the solution of the problem of smoke abatement for the past 40 years.

Following speakers somewhat dissented from this point of view, stating that as much careful supervision of smoke emission from factory and works chimneys should be exercised during the war period as at any other time.

Dr. R. Veitch Clark (M.O.H., Manchester) said the country was faced with the fact that there was now a greater degree of atmospheric pollution, and also with the existence of circumstances which made it almost impossible to avoid some of it. What was necessary was to find a *via media*—some sensible course to adopt, and mitigate the evil as far as possible.

Later, Dr. Veitch Clark proposed, and Dr. J. R. Ashworth (Rochdale) seconded, that the executive Committee of the Society be requested to take every step practicable to maintain the work of the Society during the war period. The motion was carried unanimously.

A further suggested form of resolution was remitted to the Executive Committee for consideration, in which it was stated that the Council no longer conceived it to be its duty in the national interest to restrict, but to intensify its activities during the war period, and that it should invite the co-operation and support of Government Departments, Local Authorities, and all interested organizations and individuals to assist it in making its necessary contribution to the nation's economic strength.

North British Association of Gas Managers

The Spring Meeting of the North British Association of Gas Managers was held on Friday, April 5, at the Cadoro Restaurant, Glasgow, when a large gathering of members was presided over by Mr. H. A. Aitken, of Buckhaven and Leven. We publish below the two Papers (by Mr. T. S. Lockhart and Mr. D. D. Melvin) read at the Meeting. The general business, discussions, and luncheon speeches will be reported in next week's "JOURNAL."

Gas-Making Units at Rothesay

Vertical Retorts and Water Gas Plant

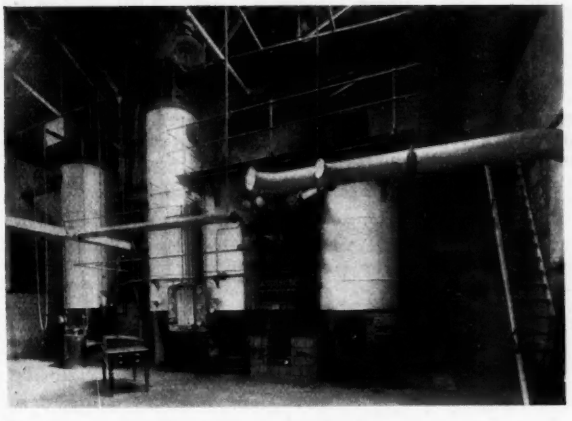
By T. S. LOCKHART, Engineer and Manager, Rothesay

Limited to about ten minutes for this Paper I will endeavour to observe the conditions and keep my remarks brief. The subject is one which can excite a lively discussion and to this end I will work, so with your forbearance some light may emerge from my efforts.

Gas Making Units

(*a*) A Glover-West vertical retort plant built in 1916, since then the retorts have been periodically renewed. In 1938 eight retorts were reconstructed to 40 in. by 19 ft. and the remaining four retorts were retained at 33 in. by 19 ft. Capacity of the plant 600,000 cu.ft. per day of 450 B.Th.U. gas. The retorts are in settings of four and units of two with one producer for each setting. The 40 in. model retorts have a common producer gas flue which enables six retorts to be heated by one producer. Installed in 1933, a 2,300 lbs. per hour Spencer Bonecourt waste-heat boiler carries on silent and useful work. Coal handling is by lip bucket conveyor while coke, with the exception of that for the producer hopper, is handled by barrow.

(*b*) Automatically operated carburetted water gas plant erected 1937, daily capacity 560,000 cu.ft. of 500 B.Th.U. gas. The unit comprises a water gas generator carburetter and a superheater in which the enriching oil gas is produced, a washer condenser, atmospheric condenser, tar separator, blowing plant (steam and electricity), and a relief holder of



Humphreys & Glasgow C.W.G. Plant

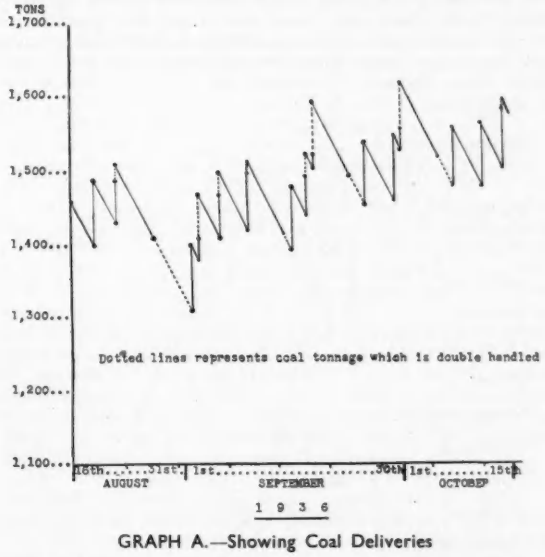
80,000 cu.ft. capacity. Oil supplies are pumped from tankers through a pipeline into an 80-ton capacity storage tank placed adjacent to the plant. Coke supplies are drawn from the vertical retort producer hopper, the fuel being hand forked before elevating.

Operating Personnel

One stoker per 8-hour shift attends the vertical retort plant with the exception of handling coal and cleaning flues. A second stoker fires two Cornish boilers, operates the water gas plant, and looks after exhauster, pumps, &c.

Coal Supplies

Coal is shipped in lighters carrying 85 tons loaded at Glasgow or Ayr. The fuel is motored from the harbour to the works. During winter months considerable expense has been incurred by handling coal out of and into stock owing to the erratic arrival of shipments. I estimate the average cost of such handling to be little short of 1s. 6d. per ton. When



GRAPH A.—Showing Coal Deliveries

such a situation now arises use is made of carburetted water gas to reduce coal used and save double handling of fuel. Graph A shows coal deliveries over a typical winter month. The cost of coal delivered to the works is as follows:

Year.	Cost of Coal.
1935-36	19s. 6d. per ton
1936-37	21s. 0d. „
1937-38	26s. 7d. „
1938-39	26s. 7d. „
May, 1939-September, 1939	26s. 11d. „
September, 1939-February, 1940	30s. 7d. „

Coke

Coke for sale is handled by barrow, and is hand forked by carting contractors taking supplies. Storage space adjacent to the vertical retorts is limited to 400 tons. From May until September each year coke sales fall almost to zero and prior to the introduction of water gas large quantities

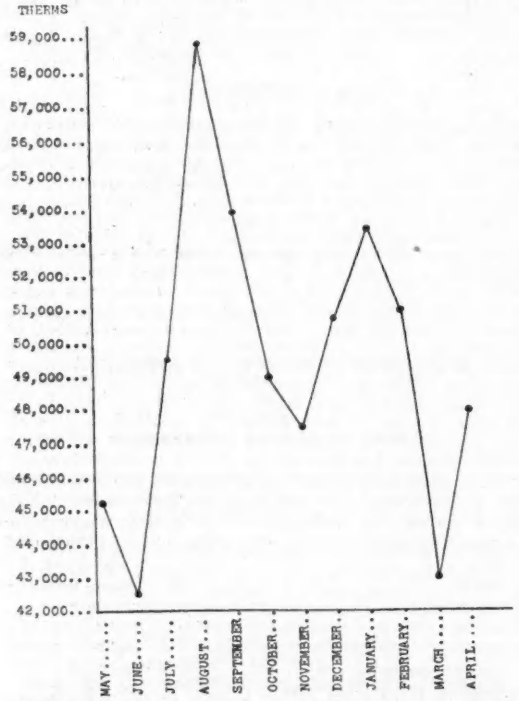
of coke in excess of 400 tons had to be stocked at almost any cost. The following are selling prices for coke:

Year.	Net Price at Yard.
1935-36	20s. 0d. per ton
1936-37	22s. 6d. ,,
1937-38	27s. 6d. ,,
1938-39	30s. 0d. ,,
Since December, 1939	37s. 6d. ,,

Working of Gas Making Units

(*a*) During the months of March, April, May and June, six of the 40 in. model retorts are at work heated by one producer. The average coal throughput is 3.25 tons per day; the producer fuel used is 3 tons per day or 15.4% of the coal carbonized. Scurfing is carefully attended to, carried out as expeditiously as possible and retorts under fire are never allowed to remain idle. When the 8 40-in. retorts are at work and both producers on, the fuel to producer rises to 18.5%. The plant is operated to give gas of a calorific value of 480 B.Th.U. per cu.ft. When eight retorts are at work two are used to carbonize a mixture of cannel coal and dross. Part of the resulting coke is used to augment the Cornish boiler fuel supply. The dross is purchased from local coal merchants at 10s. to 12s. 6d. per ton delivered at the works. Boiler fuel cannot be imported at less than 20s. per ton.

(b) The detailed operations of an automatically operated carburetted water gas plant are too familiar to you for me to waste time describing them. After three years the plant at Rothesay has given little trouble. During the early months sticking valves were frequent but this was found to be due to improper cleaning and poor greasing. The generator lining and the carburetter checkers have been renewed twice. Clinker? Yes! we get it, but it does not prove troublesome. The generator is cleaned every four hours, the operation taking twenty minutes; once per week the generator is emptied and clinker above the clinkering door level removed. Two men require two hours for this job. The works fitter spends four hours per week on routine maintenance



GRAPH B.—Showing Monthly Gas Output for Year 1938-39

of the plant. Carburetted water gas of 405 B.Th.U. per cu.ft. and is admitted to the coal gas stream at the inlet to the condenser and the quantities are controlled by a series of four cocks which admit approximately 1,200, 2,400, 4,000, and 7,000 cu.ft. per hour respectively. The proportion of water gas to coal gas is maintained at between 25% and 33⅓%. Time does not permit of my going fully into all the advantages of a works such as Rothesay having a water gas plant. I will content myself by giving a few of the more practical ones.

1. Peak loads and fluctuating demands can be coped with easily. (See Graphs B. and C.)

2. Minimize rises in cost of coal freight; and handling.

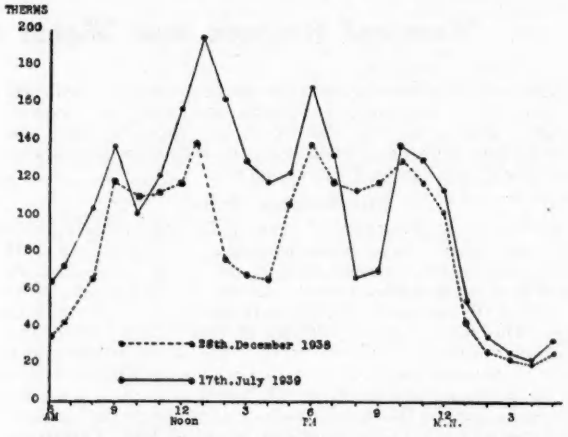
3. Increased immunity from conditions which prevail in times of emergency (strikes or war).

4. Enables control of the local coke market.

5. Reduces handling of coke into stock.

6. Extensive repairs to vertical retort plant can be effected when required.

7. Eliminates need to work third setting of retorts on part load.



GRAPH C.—Showing Hourly Gas Output for days in July and December

Work done by the water gas plant since 1937 can best be envisaged by the following figures which are for three years to Feb. 15, 1940.

Coke Used. Tons.	Oil Used. Tons.	Oil Used. Gallons.	Gas Manufactured. Cu. ft.	Gas Manufactured. Therms.	Oil Used per 1,000 cu ft. Gallons.	Coke Used per 1,000 cu.ft. lbs.
1,529	509	131,053	98,136,000	397,450	1.335	34.9

From the above table it will be noted that owing to water gas some 5,500 tons of coal fewer have been bought over the past three years and that a fair tonnage of coke has been removed from the market.

Cost of Oil for Carburetting and Electricity for Motors.

Year.	Cost of Oil. Per ton.	Cost of Oil. Per gallon.	Electricity at 1d. per Unit. Robot Motor.	Electricity at 1d. per Unit. Blower Motor.
		Pence.		
1937	£4 5 0	4.08	£2 14 0	£19 1 0
1938	£5 0 0	4.80	£2 12 5	£42 19 7
1939	£4 14 0	4.51	£2 8 0	£58 2 0
Since Jan., 1940	£7 0 6	6.70	—	—

Results of Combined Gas Making Units

I have taken from the Burgh Abstract of Accounts figures for two years' joint working of the plants and they are:

Two Years 1937-38 and 1938-39.

Gas manufactured	1,215,036 therms
Coal carbonized	12,458 tons
Gas produced	97.49 therms per ton.
Coke sold	6.04 cwts. per ton
Tar produced	20.81 gallons per ton
Cost of coal and oil, less residual products	= 2.01d. per therm.
Cost of gas into holder	+ 3.401d. per therm.

Current Conditions

I feel that some reference should be made regarding conditions since September last. Owing to restrictions you will realise that tonnage figures cannot be quoted. Many times during the past ten weeks have I been thankful for the combination of gas making units at Rothesay. In the autumn, shortage of lighters, then fog on the river in November, followed by scarcity of fuel meant a serious interference with ordinary working. Fortunately precautions had been taken to conserve a considerable quantity of good dry coke and stack it in the water gas house. In addition a portion of the yard stock was covered by tarpaulins to keep it dry. Early in December it was decided to reduce the working retorts to six, shut down a producer, and increase the make of carburetted water gas. Of the six retorts working, four were carbonizing a mixture of double and treble nuts, the remaining two cannel coal, and I had little difficulty in getting supplies of cannel. In this way the Department was saved considerable expense in not having to handle too much from stock.

Increases in cost of freight, coal, &c., and reduced output of gas have materially altered the cost per therm for coal and oil (less value of residuals). This is best illustrated by a glance at the figures since May 15, 1939, to date.

Month ending,	Cost of Coal and Oil after deducting Value of Residuals.	Progress of Gas Output.	Remarks.
June 15, 1939	2.03d. per therm	0.5% decrease	Normal months.
July 15, 1939	2.07d. ,,	1.0% decrease	
Aug. 15, 1939	2.13d. ,,	7.8% Increase	
Sept. 15, 1939	2.27d. ,,	8.58% decrease	Increase in freight, 1s. 6d. per ton.
Oct. 15, 1939	2.61d. ,,	14.3% Decrease	Discharging increase, 2d. per ton
Nov. 15, 1939	2.76d. ,,	11.6% Decrease	Coal Increase 1s. per ton.
Dec. 15, 1939	2.74d. ,,	11.2% Decrease	Coke raised by 7s. 6d. per ton
Jan. 15, 1940	2.38d. ,,	13.8% Decrease	Oil raised by £2 6s. per ton
Feb. 15, 1940	2.37d. ,,	0.5% Decrease	—

I have endeavoured to record carefully my experiences, and from them it may be that someone will see where they can improve their own conditions. On the other hand I am hoping that I may gain knowledge from your criticism which can be used for the benefit of my undertaking.

Remarks on the Effect of Storage on Coal

Paper to the North British Association of Gas Managers on April 5

By D. D. MELVIN, Edinburgh

It is estimated that gas undertakings in Scotland normally have in stock about 250,000 tons of coal mainly as an insurance against stoppage of supplies through strikes and other interruptions in the supply of coal. This stock represents a considerable amount of idle capital, continuously depreciating, and involving considerable expense in handling into and withdrawal from the stock yard which in the past has been at long intervals. Owing to the long periods between the handling of stock coal the provision of special permanent plant for expeditious and economical handling has not been warranted and there are few works where this is provided. The arrangement at one works permits of all incoming coal going to stock and the stock coal is therefore being changed continually—an arrangement which has much to commend it.

It may be that influences will be brought to bear in the near future by which stocking and withdrawal from stock may become part and parcel of our carbonization practice if the all coal gas policy so widely followed in Scotland is continued. Such proposals as equal monthly deliveries of coal supplies, backed possibly by financial inducement for coal taken over and above normal requirements during the summer months, would appear to be proposals which will require serious consideration by all undertakings.

Whether it will be more economical to install permanent plant to handle coal into and out of stock yards, to redesign our works as the opportunity arises for this purpose, to stock definite types of coal only, or to consider the adoption of alternative methods of gas production for the period of the year when the output is above the average, thus considerably reducing the tonnage of coal required, are questions which cannot be answered in a short Paper but which would well repay study. I propose in these remarks to direct attention to the effect of storage on coals.

Loss of Caking Power

North of the Border, the coals producing the most economic production results have relatively low-caking or non-caking properties and the preponderance of these coals in our coalfields is reflected in the popularity of continuous vertical retorts, which almost all medium and large sized works have adopted. Generally speaking these coals do not weather well in storage and the effect of using stock coal of this nature is known to our cost, particularly with continuous retorts. Loss of caking power is immediately reflected in the speeding up of throughput, alteration in calorific value, and the production of inferior and smaller coke. This coke passes to the producer, which on account of its design is possibly unsuited to small coke, carbonization temperatures are affected, and the whole schedule of retorting operations is upset, while saleable coke is immediately reduced and breeze accumulates. This small coke also influences the production of carburetted or blue water gas where such plants are in use, and it is estimated the output of a plant can be halved by using unsuitably sized coke—just at a time when the plant is most required.

If therefore stock coals are to be used during some part of the year the selection of the types which will give least trouble will repay any effort in this direction.

In the Edinburgh series of tests on the "Deterioration of Coal on Storage" presented in a Paper by Mr. Jamieson and Mr. Skilling at a special meeting of the Institution last year, tests on twenty Scottish coals differing widely in their characteristics were published. It will be recalled that two series of tests were dealt with. In the first the coals were stored in 10-ton lots in rectangular heaps and portions were removed at intervals of approximately 15, 24, and 44 months and tested by analysis, laboratory assay at 600° C. and 900° C., and in a small horizontal test plant. In the second series individual heaps of about 220 tons of seven of the coals were formed and these were tested in the vertical test plant, before exposure to weathering and after exposure for about 3½ years.

The twenty coals, four of which were smalls and the remainder screened coals, were arranged in three groups for the purpose of discussing the laboratory results. This grouping was determined mainly by the caking index (Gray-Campredon) and six coals with initial indices up to 12 came into the low caking group, twelve coals with initial indices over this figure into the caking group, and three coals into a cannel coal group.

The results on the small scale tests showed some inconsistencies and emphasized the difficulties of sampling small heaps of coal consisting of pieces up to 12 in. in size and containing a greater or lesser amount of coal which, on account of being on the outside of the heap, was subjected to a greater degree of weathering. Definite trends were established with certain coals, with some exceptions, and it was agreed that the results would not be generally applicable to all coals. Sufficient coal still remains for other two tests, and when these are completed the results may be emphasized and confirmed.

The Gray-Campredon caking index test revealed the extent of the loss in caking power of the coals, and of the six coals in the low caking group the low initial caking property had been lost within 15 months. In the caking group each coal showed a definite loss of caking power, although at the end of 44 months sufficient caking power remained to ensure efficient carbonization and the production of suitable coke.

The ultimate analysis revealed a definite increase in the oxygen content and the low caking coals showed an increase of 2.4, while the caking coals showed an increase of 1.5 in the percentage.

Appearance of Coke

The Gray-King assay at 600° C. showed no definite trend or changes of a conclusive character excepting in the appearance of the coke which showed deterioration. At 900° C. the assay revealed a definite decrease in the tar yield and an increase in the liquor yield, this increase being more marked in the low caking coals, providing additional evidence that these coals are more prone to oxidation on storage than the caking coals. At the end of 44 months' storage, on an average basis, the calorific value of the gas and the thermal yield showed slight increases.

Carbonization in the small experimental plant at Granton is carried out in two D-shaped horizontal retorts each holding 84 lb. coal. These retorts are now heated by a multi-jet coal gas burner to ensure the reproduction and maintenance of the temperature of carbonization at the different periods.

Over the full period of weathering of 44 months the coals in the low caking group show a decline in the thermal yield of gas of 8%, while the coals in the caking group show on the mean a loss of 3%, although one coal in this group showed a decrease of 7%. Two of the coals in the cannel group showed little change, and one showed a notable drop.

The yield of coke, as might be expected, showed little change throughout the period of storage, but the sizing of the coke produced showed how weathering had depreciated this important quality. On an average the coke produced from low caking coals fell from an initial average size of 1.34 in. to 0.90 in., that produced from the coals in the caking group fell from 2.01 in. to 1.72 in., while of the three coals in the cannel group two behaved as low caking coals in this respect and one as a caking coal. It was obvious from the intermediate tests that coals with little caking power to start with, although suitable for the production of coke when freshly mined, lost this caking power after a short period of storage. Some of the caking coals also showed an unexpectedly large decline in the size of coke produced, and it was evident that a high initial caking index did not necessarily provide evidence that the coal would "weather" well for too long a period.

It is of interest to note that the low caking coals when carbonized in this horizontal test plant produce gas which contains between 4 and 5% of carbon dioxide, the intermediate caking coals 3 to 4%, and the caking coals about 2%.

The second series of tests was an attempt to estimate the effect of storage on coals using the normal gas making plant. For this purpose, the large scale test plant, forming as it does one bed of a bench of 44 retorts, was well adapted. This bed of four retorts is valved for separation from the rest of the bench with which it normally works, and is supplied with an independent condensing, washing, purification, tar and liquor collecting, and metering system. The retorts are 76 in. major axis, and can carbonize eight tons of coal per day.

As the seven coals were laid down concurrent deliveries were tested in the plant under noted conditions of throughput, temperature, and steaming while producing a gas of 475 B.Th.U. quality. After approximately 3½ years' storage in the open, the coals were uplifted, taking care to mix the exterior of the heaps with the interior. They were then carbonized under similar conditions to the original deliveries and in the same retorts. As only a limited supply of each coal was available and the conditions of the test aimed at were three days steady running prior to the test period, it was decided to reproduce the original temperature, throughput, and steam as nearly as possible and accept the calorific value produced under these conditions. The retorts were, of course, 3½ years older, and had been repaired, while improvements had been made in the tar and liquor separating arrangements and in the measurement of steam to the retorts since the original tests.

Of the seven coals tested three were in the low caking group, three in the caking group, and one was a cannel.

The loss of caking power in practically all these coals was observed in the operation of the retorts and the volume of coke extracted per "draw" was noticeably less, this volume being used as a measure of the throughput of coal.

Drop in Calorific Value of Gas

It is obvious from a consideration of the results before and after weathering that unforeseen factors entered into the comparison and made the interpretation of the results sufficiently indefinite to prevent dogmatization. One factor was the difference between deliveries of presumably the same coal, which pointed to the inclusion of different proportions of different seams from day to day deliveries of the same "named" coal. Another was the influence of weathering on the size of the coal leading to a more densely packed retort and consequently a varying effect from steaming. The throughput of the retorts and the temperatures were reproduced almost exactly.

The calorific value of the gas produced from all coals was less, the drop varying from 10 B.Th.U. to 37 B.Th.U. per cu.ft., but the thermal yield was increased in four of the coals and decreased in three. The composition of the gas produced revealed a substantial increase in the constituent volumes of carbon monoxide and hydrogen in those showing increases; and if it were assumed that this difference is due to an increase in steam, due to the quantity in the original test being over-estimated the difference would be explained. It would appear that it would be possible to produce gas of 475 quality from the coals in question after storage at a loss of perhaps 7 to 10 therms per ton.

The coke yields showed a decrease after storage which might partly, though not entirely, be due to the influence of steam. The size of the coke produced was very much less and it was evident again that coal of low caking power produced coke so small that a serious loss of revenue was bound to result.

Loss of Revenue

The increase in the quantity of coke below 1 in. was in the case of one coal a rise from 20% to 27.4% of the total coke and in the case of another a rise from 24.2% to 53.9%. On the basis of a production of 14 cwt. per ton and taking coke at 30s. per ton and breeze at 10s. per ton the decrease in revenue is with the first coal 1s. and with the second 4s. per ton. On the retort house costs these represent increases of 11% and 45% respectively in the cost of gas.

Taking the figures from the small test plant and the grading of the coke produced in it, a highly caking coal shows a decrease, a medium caking coal an increase of 22%, and a low caking coal an increase of 72% in the retort house cost of gas from the loss of coke revenue alone, after 44 months' storage.

The result of these experiments and others which have been carried out leads to the conclusion that coal of low caking power should not be stocked unless it is to be used within a very short period of months. If it is not to be brought into use it should be renewed before depreciation becomes serious.

When and where possible highly caking coal, of a suitable quality, should be stocked when the stock is to remain untouched for some time and, where low caking coal must be stocked, a proportion of caking coal should accompany it for mixing purposes to ensure efficient carbonization.

It is obvious that if an all coal-gas policy is to be pursued the financial inducement referred to for stocking coal in the slack season for use in winter months must be substantial to compensate for handling plant, labour, depreciation, irregularities in its use, and effects on normal working.

The alternative of making carburetted water gas for peak periods should also be explored, keeping in mind that it has been estimated that excluding capital charges, peak load coal gas in one works can cost anything from two to eight times as much as base load coal gas.

No elaborate series of tests are necessary to determine the suitability of any coal for storage and the effect of storage on the coke producing quality. The W-D swelling number test, now published as a British Standard, can be used for this purpose if the appearance of the coke button is noted together with its swelling number, or better still if the buttons are mounted and retained the information accumulated will soon form a valuable guide.

This test is also very suited for the determination of the correct mixtures of highly caking and non-caking coals to give easy working and has proved its worth for this purpose.

From a Paper to the Manchester and District Junior Gas Association on March 30

MAINTENANCE OF Continuous Vertical Retorts

by
N. MATTHEWS, B.Sc.,
of Bolton

[This Paper is concerned with the upkeep and working results of two settings of Woodall-Duckham continuous vertical retorts (No. 1 upwardly heated, No. 2 downwardly heated) at the Gas Street Works of the Bolton Corporation Gas Department.]

Experiments have been made to ascertain how long a retort can be kept running between scurfing periods. The conclusion arrived at is that a working time of 4-5 weeks is all that can be expected without considerable trouble. Generally a retort will work without much trouble for four weeks, but beyond this length of time troubles start. The coal begins to hold up and a greater amount of rodding is required. Usually the trouble is worse on the offtake side, and this side ceases to work, the coal then being made to travel only down the platform side. This causes a hollow to form 10-14 ft. down the retort on the offtake side, and on extensive rodding the bridge over the hollow breaks and the top coal falls several feet. In such cases the retort has to be refilled with coke and run as a newly working retort for some hours.

If the scurf breaks away at this period the retort will work satisfactorily for some time, but more often the scurf lifts from the walls after the retort has been re-coked and bridges the retort, preventing its moving at all.

The loss in make, firing of the gas in the retort, added trouble in rodding, and necessity of re-coking do not make it profitable to run the retort any longer without scurfing.

As far as possible the retorts are now run for 30 days at a time, and put off after this period whether or not they are giving trouble.

Retorts which have developed leakage seem to fail quicker than those which do not leak. They appear to hold up about the point where the holes are. It would suggest that pieces of coke become wedged in the holes and allow more coke to adhere round them, finally forming a bridge which prevents further travel down the retort. Such stoppage is difficult to remove as it is too high to reach from the bottom of the retort and too far down to reach with the longest cutter (15 ft.) from the top. Retort leakage also gives variable flue temperatures, which in turn give varying carbonizing conditions in the retort leading to irregular flow of the charge, heavier scurf formation, and also the tendency for the scurf to lift from the walls and thus retard the flow of the charge.

Producers

The producers on both settings are the standard four-door step-grate type. They are designed to work under pressure, but on the No. 2 setting the CO pressure can be maintained without the use of the venturis and work with the cold primary slides on the doors open.

The steaming arrangements to prevent clinker are side steam pipes blowing steam across the grate and top steam pipes which blow steam into the fires above the top bar of the grate.

The side steam pipes used to be placed on the wall sides blowing towards the centre bearer. The clinker forms along the wall sides and the steam was not touching it. The pipes were changed round so that they blow steam towards the walls from the bearer, and this has reduced considerably the trouble from clinker.

The coke used is mainly draw coke from the retorts with occasional loads of screen coke, and with the normal amount of cleaning little trouble from clinkering is experienced, each producer being cleaned once per shift of 8 hours.

The venturis on the No. 1 setting are placed at the front of the furnaces, and the air steam blast travels downwards under the bottom of the furnaces, comes up inside the walls and out at the side between door and bars. Trouble has been experienced due to condensation water blocking the horizontal portion below the furnace, but since drains have been fitted to remove this water the trouble has disappeared.

The venturis steam, side steam, and top steam are fed from a common main through a reducing valve. This valve reduces the boiler pressure to a pressure just higher than the venturi pressure so that the valves can be worked almost full open and it also maintains a steady pressure irrespective of variations in boiler pressure.

The side and top steam pressures are more or less fixed and only altered when exceptional clinkering trouble warrants it. The venturis on No. 1 setting are varied to maintain the required CO pressures which must be kept constant.

The condition of the producers on both settings when emptied for inspection has been excellent. Very little brickwork has had to be cut out. It has never been necessary since altering the steaming position from the wall sides to the centre bearer to shut off any of the working producers on the No. 2 Setting for repair work.

Maintenance During Carbonization

While the major portion of maintenance work can only be done when the setting has been allowed to go cold, a fair amount can be done during the carbonizing period.

When retorts have been put off for scurfing the flues can be cleaned out and nostrils and dampers replaced where necessary. The dust which collects in the flues is scraped out. The work starts at the top of the setting working downwards to the lowest flues. Header bricks are placed at regular intervals so that by removing them the flues can be properly cleaned.

With the upward heated setting, because of the greater heats at the bottom where the dust accumulates, there is a tendency for the dust to slag and fill the nostril holes. These can usually be cleaned with suitable bars but if too bad must be cut out and fresh ones fitted. The floor of the flue should also be properly cleaned.

The main CO flues on both settings do not require cleaning very often and inspection and cleaning at six-month intervals is sufficient.

When the retorts have been properly scurfed they are tested for leakages even if none has been noticed while the retort was working, as there might be fine holes which may not show while working but would enlarge if left.

The method of testing with the No. 1 setting (upwardly heated) is to replace the top covers and insert all but one of the top plugs. The bottom covers are then removed and cold air is drawn up the retort and through any holes in the wall sides into the combustion flues, which are always under slight vacuum. The holes show up as black specks and these are tested with a pointed tool to see how extensive they are.

With the No. 2 setting (downwardly heated) by shutting the main CO_2 dampers of the retort and opening the CO dampers the combustion flue is put under pressure. This forces producer gas through any holes in the retort walls where the gas burns and the holes can be detected, or by opening the main dampers wide and closing the CO dampers a cold air test similar to No. 1 setting can be applied.

Any leakages detected are cleaned out and then filled in by shooting S-P cement into them with an E-B gun. After shooting, the cement patch is smoothed off and cannot be discerned. Holes up to 4 in. by 2 in. have been filled in this manner. When patching a hole as large as this the patch is shot over again the following day to fill-in any cracks which may have formed when the cement sets. Generally such patches will last for about three weeks before starting to leak again and the hole when examined is much smaller than before. The

presence of holes in the walls of the retort as well as causing loss of gas interferes with the maintenance of temperatures. It is impossible without upsetting the rest of the flues to supply enough air to the combustion flue with the leakage to burn all the coal gas. Also such leakages are not constant and depend upon pressure conditions inside the retort and the possibility of becoming blocked up with pieces of coke. It is impossible to make any adjustments for such leakages and the heats may fluctuate considerably with varying amounts of leakage. The best that can be done is to smother the flue by shutting off the air damper if the combustion flue is becoming dangerously hot and watch the CO_2 flue for signs of over-heating there. Any retort with serious leakage should be emptied as soon as possible.

As well as the retort brickwork requiring attention the ironwork and extractor gearing have to be inspected while the retort is scurfing.

Complete Overhaul

The main task is the examining and repairing of the retort and furnace brickwork. This cannot be anticipated to a great extent while the setting is working. As soon as the retorts are cool enough slings are placed in them and a competent person goes in to examine the retorts and decide what work is required on them. Four retorts are examined at a time; these are then completed, re-inspected, and passed, before entering the next four.

In examining the retorts the points to be noted are:

(*a*) *Spalling and Crazing of Brickwork.*—This starts at the top of the retorts and forms a triangle with the apex downwards. The distance down the retort it has travelled is noted and the depth it has penetrated into the brickwork.

(*b*) *End Joints.*—These will have opened out as the retort cools and the cracked cement is scraped out so that the amount of opening can be properly seen and the state of the tongue behind the joint examined.

(*c*) *Cracks.*—These may exist as hair cracks in the surface of the brickwork or long deep cracks continuing through several panels. The position, length, and depth of such cracks are measured.

(*d*) *Obvious Holes.*—These are tested to see how solid the brickwork is round them. They may be mere point holes on the surface. Such pin holes may open out into large holes behind, so it is necessary to cut round the holes and open them up to see the state of the brickwork behind. Sometimes there are several small holes in line, and when tried these will open up into a large narrow hole. Holes which have been partially filled by gun patching should have the cement cut out, as this will probably crack when re-heated.

(*e*) *Bulging.*—The walls may show signs of bulging. This can be seen in bad cases or, where doubtful, test with a long straight edge.

(*f*) *Bottom Silica Joint.*—The joints between the silica brickwork and bottom firebrick courses are examined and the condition is carefully noted.

(*g*) *Bottom Firebrick.*—This is usually worn away by friction of the coke. The depth and extension of such erosion are measured and the necessity of fresh brickwork decided upon.

(*h*) *Extractor Gearing.*—To save time, the condition of the hangers, extractor roller, and bearings can be seen while inspecting the bottom of the retort. Any broken or cracked stars should be reported, the wear on the bearing noted, and each hanger tried to see that it swings freely.

Examination of Producers

As soon as the producers have been emptied the clinker on the back and side walls must be chipped off and then they can be examined. The points to be noted are:

(*a*) The extent and depth of brickwork which has been eroded or perished on back and side walls. The walls must be tried with a light hammer as bricks may look all right but as soon as struck the face will fall away. An estimate of the amount of brickwork which will have to be cut out and replaced is made.

(*b*) The state of the bottom brickwork, bearers, door, and steam pipes.

(*c*) The condition of the brickwork higher in the furnaces. This is usually where cracks appear and the extent, position, and depth of all such cracks must be noted. The mid-feathers are usually cracked and the arch may have sagged. The possibility of having to rebuild these must be considered.

(*d*) The brickwork round the charging doors may be badly worn and may have to be replaced.

From the furnaces it is possible to see into the main CO flues and examine them as to whether they require cleaning out. The dust which has collected here may still be loose and easily cleaned out, or may have fused, when the cleaning out will present considerable difficulty. This fused dust is extremely hard and the space in which the cleaners have to work is very restricted.

The waste gas flues are examined in conjunction with the downtakes to the waste heat boilers. They will require cleaning out. In the waste gas collecting flues the dust may have fused but in the main CO_2 flue and boiler downtakes the temperature does not get high enough for fusion and the cleaning is much more simple.

Having ascertained what work requires doing it is then necessary to arrange the work so that it can be most expediently done. While the bricklayers start at one end of the setting repairing retorts, fitters can start at the other end attending to ironwork and extractor mechanism.

When repairing the retorts it has been the practice as far as possible to avoid cutting out panels. In order to replace a panel it is necessary to cut out several surrounding panels in order to find a good tongue or groove from which to start rebuilding. The last joint made must necessarily be a straight joint, the tongue having to be cut off to get the panel into position and this joint is a point of weakness and a potential leak. Also in cutting out so much brickwork the surrounding brickwork is sure to feel the strain and cracks may open up. Instead the holes are patched with S-P cement. The hole is cut away so that it tapers from front to back, pieces of wood are knocked in so as to form a wall at the back of the hole, and then the hole is filled with cement. The cement is made up into a ball the size of the hole, placed in one piece and hammered up tight. S-P cement has very little shrinkage, but to make sure old silica bricks are powdered up and added to the cement. The cement is skimmed up level with the wall. All joints are raked out and repointed with cement. Retorts having large holes are examined when the patching has been done to see that it is satisfactory and all the retorts are examined from top to bottom as soon as the grout is dry enough, careful watch being kept for any badly filled joints or cracks showing in patches. Such defects must be rectified before the retort can be passed as satisfactory.

Results of Keen Maintenance

In 1934 the combined make per ton from both settings averaged over the year was 18,191 cu.ft. This has been increased to 19,279 cu.ft. in 1938, showing an increase of over 1,000 cu.ft. The declared calorific value is checked by the Official Examiner on a continuously recording Fairweather calorimeter.

Year.	1934.	1935.	1936.	1937.	1938.
Make per ton ...	18,191	18,933	19,267	19,183	19,279

The details of the increase for each setting are:

No. 1 Set. ...	19,000	19,200	19,400	19,400	19,400
No. 2 Set. ...	17,500	18,200	18,400	18,400	18,600

No. 2 setting, which is much older than No. 1, shows the effects of careful attention better than No. 1, but with both settings the results justify the greater attention given.

While the efficiency of the settings has been increased, the cost of renewals and maintenance of the settings has been decreased.

Date.	1934.	1935.	1936.	1937.	1938.
Cost of renewals and repairs to both settings ...	£3,920	£4,086	£2,740	£2,679	£2,396

As regards the life of the setting, No. 1 setting started making gas in October, 1933, and at March 31, 1939, will have worked 1,750 working days. No. 2 setting commenced gas making in February, 1928, and will have done 3,360 working days by March 31, 1939.

During this time the only major repair work which has been carried out was on No. 2 setting. In 1934 the top 8 ft. of

brickwork was removed and rebuilt and the whole of the retort faces relined.

The time for re-setting has been passed and the setting is, as far as one can ascertain, in good order, and there is no reason why it should not run until 1941 before re-setting. At the same time the figures as shown in the yearly abstract show an increase, while the maintenance costs have been reduced.

The above figures for the increase in make per ton, reduced cost of maintenance, and the length of life of the settings, especially No. 2, would indicate that regular methods of control and systematic attention of the plant are well worth while.

DISCUSSION

Mr. **H. V. Dann** (Blackburn) enquired if any effect had been noticed in Bolton in regard to the sizing of the coal carbonized. With a Glover-West setting at Blackburn it was essential to keep the throughput on the low side, and as steady as possible. With a given setting it had been found that coal carbonized over 1 in. in size had a definite effect, in some instances the throughput being reduced by as much as 1½ to 2 cwt. per day. It had been possible to plot curves showing the variations.

Mr. **J. A. Speers** (Preston) said the inlet temperature of the waste gases to two boilers at Preston varied as much as 150°. This difference would have a considerable effect on the life of the boiler tubes. Had Mr. Matthews noticed a similar difference at Bolton? How did they clear the boiler tubes? Some found that the tubes were kept clean by blowing shavings through weekly, while others passed a drill through.

Mr. **J. C. Hogg** (Stretford) asked if any change had been noticed in the deposits removed from the waste-heat boiler tubes during cleaning. He noticed from the Paper that boilers working in parallel show certain fluctuations of inlet temperatures. It was possible to increase the dew-points of the waste gas, so that the deposits appeared in viscous form. Any leakages would be highly corrosive and cause considerable wear on the flues.

Mr. **Matthews** stated that Nos. 1 and 2 boilers had to be run at 900° and 800° to meet the requirements of the Insurance Company. No viscous deposit had been observed. The waste-heat boiler tubes were cleaned each month, by pushing a long bar through each in turn. Mechanical means were not used. It took about a day's time to clean a boiler. He had no information in regard to the effect of coal size on throughput, but when a strongly caking coal was carbonized it tended to slow down the throughput.

Mr. **E. B. Fields** (Blackburn) enquired if any information was available concerning the new cement welding plant. He was informed that the apparatus had only been in use for six months, and it was inadvisable to give any definite information at this juncture.

Mr. **R. L. Greaves** (St. Helens) said he had gained his experience in four works in different parts of the country, using different qualities of coal, and he was always intrigued when such large figures as 90 therms per ton of coal carbonized were given. With scientific men controlling the plants, the results had invariably been 82/84 therms per ton of coal carbonized, with calorific values of 450 to 475, and to obtain more had been difficult, even with the skilled operators of the contractors. He would like to learn the secret of obtaining 90 therms, with the same yield of residuals.

Mr. **F. Cartledge** (Oldham) enquired whether the working conditions were easier for the operator on the top of the settings with upward heated settings.

Mr. **Matthews** replied in the affirmative.

Mr. **H. Carter** (Liverpool) said that at Liverpool scurfing was done every thirty days. Experiments had been carried out by blowing air in from the top, and it was found that the scurfing period had been reduced from 2½ days to one day for an 85 in. retort.

Mr. **Matthews** stated that scurfing had been done at Bolton in 24 hours, but about three days were usually taken, during which period any patching work was carried out.

Mr. **Dann** stated that he thought it was an open question whether it was an economic proposition to attempt to scurf a retort in such a short time.

Mr. **Carter** contended that it had a very detrimental effect on the retort to allow it to cool at the bottom, and then to be heated up again. By blowing air in at the top, the bottom could be kept closed, and the temperatures remain constant all the way up the retort. There was also the factor of getting the retorts to work earlier, after scurfing.

Mr. **Applebee** (Manchester) proposed a vote of thanks to the Author for his Paper, and Mr. **Cartledge** seconded.

Scottish Junior Gas Association

(Western District)

From the Presidential Address

of

E. G. SMITH, Dumbarton

MORE vigorous research applied to the possibilities of total gasification would afford greater stability to the cost of production and in turn to the selling price per therm, a very important point to those competing for industrial loads. Even lower calorific values may have to become the order of the day, and why not? Many undertakings have travelled part way in this direction by installing blue and carburetted water gas plants, which, to my mind, should operate to produce more stabilized cost conditions than increasing production of residuals, thereby increasing the liability of interference by outside influences on the financial results. The rising cost of the raw material, coal, can be taken care of by improved processing in carbonizing practice, in which recent research discloses infinite possibilities.

The initial step in increasing gas sales is the marketing of appliances. The variety of domestic units and their many uses provide a wide field for marketing, which is now attacked by well planned national campaigns backed by local effort. Co-operation, it is agreed, is essential for the success of sales campaigns, yet to anyone dealing with the sales of appliances it does seem strange indeed that such disparity of selling prices of appliances exists between different undertakings. Some undertakings place apparatus before the consumer at less than cost price, while others seek to make profit on the actual sale. Many salesmen are being confronted with this problem by consumers possessing knowledge of low prices ruling in neighbouring undertakings, and while cheaper gas or free maintenance may be offered as the reason, the higher comparative initial cost still remains a bitter pill for the consumer. Surely it is not beyond the ability of gas undertakings to find a common basis of charge, not necessary national, but at least in areas, whereby this anomaly could be removed.

What the charge should constitute is not a point upon which one can dogmatize, but suffice to say that indiscriminate selling prices, low or high, can be a very dangerous practice to any undertaking. Excessive charges may prevent realization of profits, while low charges can discredit any financial benefit obtainable from gas sales. The latter remark appears as a condemnation of the "free loan policy" and as such is intended. In the past, free loan appliances, it is acknowledged, laid the foundation for the popularity of gas in the home of to-day, and in reality was a form of publicity suited to a period when the advantages of present methods of sales publicity were not appreciated or thought of. The fixing of appliances to consumers whose incomes do not permit them to use them can hardly be considered good business, or at any time be termed salesmanship. The modern designs and finishes in gas appliances offered on cash or deferred payments and backed by present-day sales and publicity are a sounder contribution toward increased gas sales and a lower priced therm.

"Service after Sales," as consumers' maintenance is termed, is essential if the appliances we sell are to be retained on the district. Gas appliances, like all machinery, cannot be considered trouble-free, and the real success of maintenance can only be accomplished by preventing complaints, and not by repairing the fault after it has occurred.

The first essential towards good operation of appliances lies at the works. Close control of the calorific value, composition, specific gravity, and pressure at which the gas leaves the works is necessary. Further contribution may be made by gas drying, thus reducing local stoppages in mains and services. Renewals of mains and services and meters to ample capacity must be accepted if new appliances are to give satisfaction.

Maintenance of appliances on the premises requires the services of a fitter possessing a comprehensive knowledge of operation and adjustment of appliances.

Facilities for training schools are not available in the smaller sized undertakings, but groups could be arranged at convenient centres, where men, chosen for this important job, could receive a periodical course of instruction from manufacturers' representatives, who undoubtedly would co-operate. Fitters have been termed the ambassadors of gas, and one can imagine the impression left in a consumer's mind when the fitter expresses doubt, or fails to locate the trouble, or tackles the job with only a hazy idea of how and when he will finish. A fitter armed with sound knowledge, and carrying out the job in an efficient manner, makes a good impression on the consumer and reflects favourably on the undertaking. The return from money spent on consumers' maintenance is hard to assess; nevertheless, a properly trained man will undoubtedly reduce maintenance costs and increase the returns, thereby justifying that little expense necessary to complete his training.

DISCUSSION

Mr. **W. Kirk** (Motherwell, Vice-President of the Association) said he did not agree with Mr. Smith in his references to complete gasification, and did not think that this method would stabilize cost. Plant should be capable of adaptation to varying conditions, giving coke when desired and gas when desired. Complete gasification meant lower calorific values, and this might lead to the necessity of installing new mains in districts where the present mains were to some degree overloaded. Regarding the question of free loan appliances he did not agree with the President in his remarks. The working man might be deprived of a necessity through his inability to pay for a cooker. This would not be fair.

Mr. **C. A. Poulson** (West's Gas Improvement Company) said that on referring to analysis it was seen that the output of gas in Dumbarton had increased 50% in the last four years and 100% in the last seventeen years. The industrial output had increased only 7½% during the past few years, so that gas to the domestic consumer had increased by over 40%. These favourable figures reflected the advantage of a rigorous sales and service policy, referred to in the Address. Low priced gas also played its part in obtaining these increases. The average price in Dumbarton, including an increase due to the advanced cost of coal, was below 3s. per 1,000 cu.ft. and was among the lowest in Scotland.

Mr. **J. Bell** (Engineer, Manager, and Secretary, Dumbarton Gas Department), speaking of service, remarked that in Dumbarton they had a fitter per 500 consumers and he did not think that this could be bettered in Scotland. Their policy was to make the price of goods cover the net cost of fixing. He was not satisfied with less than 20s. sales per consumer per annum, and last year their sales had averaged 25s. per consumer. A vigorous and aggressive sales policy had made substantial inroads in a district which the local electricity supply company said was one of their finest districts and a stronghold of electricity.

Mr. **T. Stirling** (Kirkintilloch) said they heard time and time again of the ease with which students in certain districts surmounted the obstacles of examinations, while those in other districts stumbled and fell. He suggested that it was not the Education Scheme that caused the trouble, but the administration of the Scheme. Since in the major examinations of the Institution all the Papers were the same for varying parts of the country, and everyone had an equal chance of some measure of success, it must be in the ancillary subjects that the trouble was to be found. In this particular aspect of the Scheme the Institution was to a very great degree at the mercy of the Technical Institutes which catered for the needs of all classes of student, not the greatest of whom, in their point of view at any rate, was the student in Gas Engineering. Such a student must conform to the curriculum imposed by that college at which he was in attendance, and if in his point of view the curriculum was more trying than one in operation elsewhere, then he was afraid that there was nothing that could be done about it.

Mr. **T. Rowan** (Grangemouth) thought that initiative as well as the price of gas had brought useful business to Dumbarton.

Mr. **D. Beavis** (Helensburgh), regarding practical training for the gas fitter, thought that something more standardized was required. The Industry could not afford unremunerative consumers, and something must be done to make them remunerative.

Mr. **N. C. Sturrock** (Greenock) concluding the discussion, said he was in favour of free loan appliances in working-class homes.

Mr. **Smith,** replying to the discussion, said he was not dogmatizing in regard to complete gasification, but he had a preference for it. Mr. Kirk had mentioned the necessity of flexibility in the carbonizing plant, and Mr. Smith suggested that they were both striving after the same results, but by different methods. Regarding the question of lower C.V. he thought that a gas of 400 B.Th.U. was preferable to one of 500, provided the lower quality gas was low in inerts, since it had a higher flame temperature. It was a prudent policy to make the district suit the works, and he deplored the remarks of Mr. Kirk regarding the overloading of mains. The question of free loan cookers was next dealt with by Mr. Smith, and he said that these cookers were invariably the black type and that no matter how they might be camouflaged they could not take the place of the higher grade cooker. On the question of education, he had some trenchant remarks to make regarding the Junior who expected his certificate handed to him on the minimum expenditure of time and energy on his part.

Sales Organization of Blackburn Gas and Electricity Departments to be Amalgamated

Members of Blackburn Town Council indulged in some straight criticism, on April 4, during a three hours' debate on a resolution by Councillor R. F. Mottershead (Council leader) for the amalgamation of existing sales organization and showrooms of the Gas and Electricity Departments, the introduction of joint reading of gas and electricity meters, and the adoption of a system of continuous billing.

The resolution, which was approved by 27 votes to 12, proposed to set up a standing committee to control the proposed joint sales organization, the precise functions and personnel of which will be settled by a committee consisting of the Chairman and Vice-Chairman of Gas, Electricity, Finance, and Gas and Electricity Joint Sales Committee.

Councillor Mottershead said the scheme had 100% support of the Borough Treasurer, and the good wishes of the Gas Engineer, but was faced with complete opposition from the Electrical Engineer. He visualized the appointment of a new and first-class official with a good knowledge of electricity and gas sales who would have the status of a chief official. This official's task would be to co-ordinate sales, and he would take over the existing organizations with their technical men. Probably he would eventually operate from one showroom but would continue to allow two separate sides to develop simultaneously through their own activities.

Dealing with a report of the Electrical Engineer (Mr. R. H. Harral), Councillor Mottershead objected to the opening sentence "that joint meter reading appeared to the man-in-the-street as very desirable, but investigation and experience had proved conclusively that the present practice of keeping control under the management of the Departments concerned was one which could not be improved upon on the ground of economy, efficiency, and service to the consumer." How could it be proved conclusively when the Borough Treasurer did not agree? The financial changes would not be introduced until the Finance Chairman and the Borough Treasurer were satisfied the time was opportune. There was no intention to disband the Gas and Electricity Committees. They would function as Works Committees, and the new official would co-operate with the Gas and Electrical Engineers.

Councillor Tempest, seconding, said the cost of running two separate showrooms for the Departments was considerable and a great drain upon their resources. He believed the establishment of one, representative of the two Departments, would mean a tremendous saving.

Councillor E. Woolley opposed a joint sales organization which was impracticable. If this resolution was adopted Blackburn would be the only authority in the country to run a joint sales organization on the lines suggested. Councillor Eastwood said money was thrown away in wasteful competition between the two Departments.

Alderman Critchley (Chairman of the Electricity Committee) said Councillor Mottershead could have put his plans before the last two meetings of the Electricity Committee of which he was a member, but he had not the courtesy to do so. He was utilizing his majority on the Council to carry the matter through. He complained that the Conservative caucus took advantage of discussing this subject while he (Alderman Critchley) was away and without having even heard him as Chairman on the subject. He was so concerned about the issue that he communicated with the Electricity Commissioners, and their reply expressed some concern at the terms of the scheme. The plans, the Alderman added, would be detrimental to the Electricity Undertaking and would not help the Gas Department one iota.

The Mayor (Councillor E. Porter), for several years Vice-Chairman of the Electricity Committee, said whether the resolution went through or not would make no difference to the Act of Parliament governing electrical affairs. He complained that none of the chief officials had been asked to submit any report on these proposals. "I am not worried personally whether this goes through or not, because I am confident those in higher authority will prevent you from committing municipal suicide," he added.

"Modern Gas Storage"

A written reply by Mr. S. Clayton Thomson to the Discussion on his Paper to the Institute of Fuel ("JOURNAL" of March 6).

THE reply given at the Meeting covers most of the queries raised regarding the medium. Both Dr. Anderson and Mr. White question whether the presence of an excess quantity of dust in the gas would not cause trouble. Up to the present time none has been encountered even in extremely bad cases on unpurified blast furnace gas; any dust which become entrained in the tar settles out, and can be removed if necessary from the collecting chambers. It must be realized, of course, that the greater part of the gas does not come in contact with the tar, and the dust is deposited upon the gasholder bottom whence it can be cleared away by special draining arrangements.

The point as to whether the medium would freeze in cold weather due to any entrained water has also been raised. To my knowledge nothing of this nature has been encountered in this country or in America, where temperatures down to 30° below zero are met with. The 20,000,000 cu.ft. gasholder in Chicago was working very satisfactorily when I visited it, though the temperature was 100° below zero. This immunity to freezing is probably due to the water being broken up into minute particles in the tar, and the water content being, say, between 1% and 2% it can readily be understood that it will have little effect upon the whole bulk of the medium.

The temperature range over which the sealing medium is effective is very great. To Mr. Silver's suggestion that conditions in this country are more severe than in Australia, and thus prevent the speed of 3 ft. to 4 ft. per minute, I would point out that the temperature range for the holder described is 65° to 70° F. as big a range as will normally be met with in England. It is interesting to hear of the formulæ Mr. Silver's Company employ for calculating the piston rates and tar losses, and they are to be congratulated in taking these precautions. However, blast furnace and coke oven installations, even in this country, must of necessity move at the rates given, and do so with safety. Furthermore, it must not be imagined that this results in a high number of pump runs. Those given in the Paper are quite normal.

The cost of pump operation, along with that of tar re-conditioning, and inspection has been raised, but this in reality is not great; a £10 note should easily cover the annual electricity charges, including internal hoist, on a holder such as described in the Paper, and periodical inspection is little in a works where a chemical staff is employed. It may be found that additional conditioning oil would have to be added occasionally, but the cost would not be great, and that is all that is necessary to keep the medium in good order.

Mr. Milbourne has suggested that the de-watering devices constitute auxiliary plant. I can hardly agree with him on this point. They are entirely automatic in operation, and are constituent parts of the gasholder, being no more auxiliary than an oil filter to a motor car engine.

Life of Canvas Seal

Regarding the life of the canvas seal, there is no reason why it should not last as long as the holder itself. The canvas, or sailcloth as it might be more rightly termed, is specially treated before being used, and is kept in good order by the medium. There are no working parts, and consequently there is no wear. Those seals which have been inspected after being put out of action have been in perfect condition, and show no signs of deterioration. I certainly have not heard of any holders of British make which have had to be put out of action for renewal of seals due to wear or old age; nor is it possible to imagine this.

The question as to what kind of jointing material is used on the shell side joints of a M.A.N. holder has been raised by Mr. Busbridge. Various types have been tried, the most suitable being one with a graphitic base. This is not attacked by the sealing medium, resulting in no leakages. It is also used on the piston and bottom seams of the holder, which, of course, are tested before being put into use.

The setting of the piston rollers is most important to ensure a level piston. All the rollers are adjustable and they have to be carefully set before the holder is put into action. Provided this is done and the piston properly balanced it should keep good working levels. I should not like to say that the shell is more flexible in the middle than at the top and bottom—in fact, the design does not allow for this as it would certainly affect the piston levels. As indicated in the paper these vary to a certain extent with atmospheric temperature, but even so there is a certain flexibility in the piston which helps to balance the effect of shell expansion. The figure given in the paper was not obtained through tight setting of the rollers, a practice which is to be condemned and which does not get the best out of this type of holder.

In dealing with the re-levelling of a waterless gasholder due to uneven ground settlement, I can say that one of the M.A.N. type was re-levelled in Germany some years ago, and as far as I know has worked satisfactorily ever since. There was no wracking or distortion of the structure or piston, nor is it to be expected with such a rigid construction. Jacks were fitted to the corner stanchions, and the comparatively light structure easily lifted to the correct level. The bottom was packed and concrete run under the bases and periphery to give it its new position.

The Corrosion Problem

The corrosion problem has been raised in a number of contributions and various causes suggested. The dropped deck piston was designed to overcome this by dipping the underside in oil, the first one being built for the storage of water gas which had proved very corrosive. This type of piston has a raised portion in the deck over the inlet pipe, which is so arranged to allow the piston to be inflated after it has landed in the oil.

The full discussion of this problem is not in the scope of this Paper. It is sufficiently big to warrant a Paper being written on it alone. However, I do not think I am incorrect in my remarks relating to the potential corrosive qualities of the gas stored in the waterless holder described. Admittedly oxygen is necessary for corrosion, but with high quantities of H_2S present as well, along with CO_2, CO, and a high water content, corrosion is bound to be active. The H_2S under the high temperatures would form weak sulphurous and sulphuric acids. Sulphur would be deposited and sulphates formed, and many other reactions could take place with other impurities which in all probability would be present. Internal corrosion troubles in Australia, as well as in other hot countries, are more severe than in England, and I have seen a number of water-sealed holders severely corroded on the North (sunny) side in that country. The average temperatures of anything from 65° to 85° F. are ideal for corrosive action; so great care has to be taken to ensure that as clean a gas as possible is stored.

Little oil filming is done, as it has been found that it will not stick to the plates in the high temperatures. Corrosion is usually found to be most active behind the vertical stays, on sheet laps, and any other ledges, and is found usually on parts of the holder which are not submerged often. The interior of these holders must be very humid, due to the rise in temperatures during the day time; so Dr. Foxwell's theory of the deposition of salts, which could be both from the water and the gas, is probably correct. Nor can electrolysis be ignored in these climates, and I can quite believe that electrolytic action is set up between the warm and the cool parts, and is, in fact, more or less proved by the fact of the corrosion being most severe on the hot side of the holder.

As regards material, it has been found, as is generally acknowledged in this country, that puddled iron resists these conditions more successfully than steel, and it is being used to quite an extent in that country.

In conclusion, I should like to say that the choice of a gasholder, as Dr. Anderson states, is a matter of opinion, and also of circumstances. The Paper in the main illustrates the installation of an M.A.N. holder in circumstances which, it is plain to see, obviously called for that type, and its advantages have been shown. Not all contributors seem to have realized this. The descriptions of various types of holders from their inception have also been traced, but to go into direct and detailed comparisons for an unknown set of conditions would be a very lengthy task. Prior to the war all types were being erected in England, the stronghold of the waterless type being the coking and steel industries, where, it should be noted, working conditions are severe on gasholders. Surely this, and the fact that in the United States practically all holders of any size that have been installed during recent years are of the waterless type, is sufficient vindication of their ability to stand up to hard and continuous work.

Gas Undertakings' Results

Australian Gas Light

The dividend of 6% on the "A" and "B" shares for the year 1939 which is being paid by the Australian Gas Light Company, of Sydney, New South Wales, will leave to be carried forward a balance of £1,776. The dividend was the same for the preceding year, when the sum carried forward was £57,080. Sales of gas to general consumers in the past year, at the same price of 0.428d. per gas unit, brought in about £20,000 more, but manufacturing costs are over £50,000 up, and the balance carried to Profit and Loss Account is almost as much as this less than was the case in 1938. Receipts from residuals are nearly £12,000 down. The capital of the Company was further increased during the year by the issue of 35,000 "A" shares.

Dublin

The total quantity of gas sold in the six months ended December last by the Alliance and Dublin Consumers' Gas Company was 6,863,858 therms, which compares with 6,738,833 therms in the corresponding half of the preceding year. This gain is in spite of the fact that the consumption for public lighting fell from 106,591 therms to 59,623 therms; the number of public lights being reduced from 3,662 to 1,110. The profit on Revenue Account is £65,534, against an amount of £77,847 for the final half of 1938. Payment of a dividend on the consolidated ordinary stock at the rate of 7% per annum will leave a balance of £6,979 to be carried forward. For the corresponding six months the dividend was at the rate of 8% per annum, with a carry-forward of £16,788.

Hornsey

Since the outbreak of war, the Hornsey Gas Company, like others, have had to meet serious extra costs, while at the same time the output of gas has decreased. The accounts for the past twelve months show a balance of revenue carried to Profit and Loss Account amounting to £26,743, which compares with £31,851 for 1938. The total quantity of gas sold was 679,056,000 cu.ft. In the preceding year the quantity sold was 736,586,300 cu.ft., while in addition 188,661 therms were sold as benzole. For the six months ended December last, the Directors recommended the payment of dividends at the rates per annum of 5½% on the 5% stock and of 4% on the 3½% stock, as compared with 7½% and 6% per annum respectively previously paid on these stocks. There is left to be carried forward the sum of £11,539, as against the £14,736 brought in.

Jersey

While the Directors of the Jersey Gas Light Company, in their report for the year 1939, state that the number of consumers continues to increase (175 having been added during the twelve months), gas sales for the year show a decrease of just over 3%, owing to the national emergency, and to the consequent curtailment of the visitor season. The total quantity of gas sold during the year was 319,784,300 cu.ft., which compares with 330,032,800 cu.ft. in 1938. Of this difference, some 5½ millions is accounted for by the reduction in the estimated consumption for public lighting. The balance of revenue carried to Profit and Loss Account on the present occasion is £10,417, as against £11,924 a year ago. A dividend of 8% for the year on the ordinary shares will leave the sum of £7,797 to be carried to the next account. A year ago the dividend paid was 9%, and the carry-forward £7,354. The Directors record with regret the death of Mr. Harry Morris, Managing Director, which took place in April last year.

Leamington

The Leamington Priors Gas Company, making up their accounts half-yearly, have on the present occasion to deal with a period two-thirds of which was passed under war conditions, instead of the one-third included in the accounts of the undertakings that are made up annually to December. Thus the decrease in gas sales of 14,000,000 cu.ft., as compared with the corresponding half-year of 1938, is equivalent to 6½%. As a matter of fact, the make of gas last year was only 1% less than the 1938 figure. The balance of net profit for the six months is £9,542, as compared with £9,956 for the last half of 1938. The statutory maximum dividends for the half-year have been declared, at the rates of 10% per annum on the Class "A" ordinary shares and 7% per annum on the Classes "B" and "C" ordinary shares.

Maryborough, Queensland

The progressive policy of the Maryborough (Queensland) Gas and Coke Company, Ltd., in doing everything possible to make gas a popular commodity has been, the Directors say, a contributing factor in securing increased business during the six months ended Dec. 31 last. Gas sales, &c., show a substantial increase of £423 over the corresponding period of 1938, and are, as a matter of fact, actually the highest sales for the past eight years. The growing demand for gas refrigerators and stoves is regarded by the Directors as particularly gratifying. The payment of a dividend at the rate of 5% per annum will leave a balance of £362 to be carried forward to the next half-year.

Minehead

Consequent upon Associated Gas and Water Undertakings, Ltd., acquiring the majority of the voting capital in the Minehead Gas Light and Coke Company, Ltd., the Board has been reconstituted, with Mr. W. H. Bennett as Chairman. The Directors state in their report for 1939 that the business of the Company continues to show satisfactory progress. The quantity of gas sold was 67,059,900 cu.ft., which compares with 61,073,800 cu.ft. in the preceding year. The unaccounted-for gas comes out at the low figure of 2.94%, as against 4.11% a year ago. The balance of revenue carried to Profit and Loss Account is £5,074, as against £4,420 in 1938. With the dividend repeated at 8% on the original ordinary shares, the carry-forward is £1,875, as compared with £1,287 a year ago.

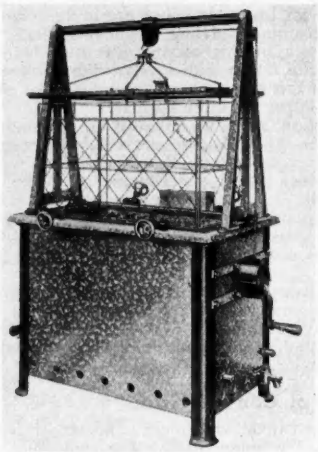
Tunbridge Wells

The total quantity of gas sold by the Tunbridge Wells Gas company during the past year was 2,432,110 therms, which compares with a total sale of 2,398,167 therms in the preceding twelve months. On the present occasion the sales include 124,753 therms recovered as benzole, as against 70,141 therms in 1938. The balance of revenue carried to Net Revenue Account is £22,465 in the 1939 accounts, as compared with £21,931 a year ago. The dividend on the sliding-scale stock for 1939 is at the rate of 7%, compared with the rate of £7 4s.% previously paid on this stock. After payment of this, and of a dividend of 5% on the maximum stock, there will remain to be carried forward a balance of £21,486, as against the sum of £25,372 brought into account.

Trade News

Gas-Heated Decontamination Boiler

An A.R.P. decontamination boiler has just been put on the market by Radiation, Ltd., which is claimed to simplify and render less laborious the work of decontaminating clothing. The garments to be treated are placed in a two-tier wire basket, the front of which is hinged for easy loading. The basket is raised and lowered into the boiling tank by a hand-winch. Locking wheels, which afford an easy handgrip, clamp down the rubber seated lid to ensure steam-tightness.



Radiation Decontamination Boiler

Luminous flame burners provide facile control; when the process is completed with one load, the gas can be turned down to keep the water at boiling point without waste. After three loads have been processed, the tank should be drained, for which purpose a draw-off tap is fitted.

The standard boiler is designed for gas heating, but connexions are provided whereby an available steam supply may be utilized for heating the water. In this latter case a copper heating coil, through which steam circulates, is fitted at the bottom of the tank. These coils are tested to withstand pressures up to 80 lb. per sq. in. The capacity of the boiler is six to eight suits of heavy duty jackets and trousers. Twelve pairs of gumboots can be accommodated at one loading.

The following are the principal specifications:

Overall			Over Cornice		Capacity of Inner Tank	Connexions			Full-on Gas Consumption	Fume Vent	
H.	W.	D.	W.	D.		Gas	Water	Steam	Per hour	W.	D.
in. 79½	in. 64½	in. 34	in. 48	in. 30	gall. 80	in. 1¼ gas	in. 1 gas	in. ¾ gas	B.Th.U. 200,000	in. 12	in. 4

Current Sales of Gas Products

The London Market

April 8.

There are no changes to report in the values of tar products in the London market, to-day's prices being approximately as follows :

Pitch 50s. per ton f.o.b.

Creosote 5d. per gallon.

Refined tar 3¾d. to 4d. per gallon.

The price of pure toluole under the Ministry of Supply Order is just under 2s. 5d. per gallon.

Pure benzole 1s. 10d.

95/160 solvent naphtha 1s. 11d.

90/160 pyridine 16s. to 17s.

All per gallon naked.

Refined naphthalene crystals about £20 per ton in bags.

All *ex* makers' works.

The Provinces

April 8.

Crude Gas-Works tar, 27s. 9d. to 32s. 9d.

To avoid misunderstanding, it is necessary to state that the above price is not claimed to represent a market value. It is a price worked out from week to week upon a system which has been used for many years as a basis for the fixing of certain contracts for crude tar of varying qualities in different areas.

The average prices of gas-works products during the week were : Pitch—East Coast, 47s. 6d. to 52s. 6d. f.o.b. West Coast—Manchester, Liverpool, Clyde, 47s. 6d. to 52s. 6d.* Toluole, naked, North, 1s. 9½d. (Controlled by the Ministry of Supply Order No. 1, which fixes the maximum price at which this material may be sold). Coal tar, crude naphtha, in bulk, North, 9d. to 9½d. Solvent naphtha, naked, North, 1s. 8d. to 1s. 9d. Heavy naphtha, North, 1s. 4½d. to 1s. 5½d. Creosote, *ex* works, in bulk, North, liquid and salty, 4½d. to 4¾d.; Scotland, 4½d. to 4¾d.; low gravity, 4½d. to 4¾d. Fuel Grade, 4d. to 4¼d. Carbolic acid, 60's, 3s. 6d. to 3s. 7½d. Naphthalene, £15 to £20. Salts, 75s. to 85s., bags included. Anthracene, "A" quality, 4½d. to 4¾d. per minimum 40% purely nominal. Heavy oil : Unfiltered anthracene oil, (min. gr. 1,080), 5¼d. to 5½d. ; filtered heavy oil (min. gr. 1,080), 5¾d. to 6d. ; heavy anthracene oil gr. less than 1,080, 6d. to 6½d.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls, whatever they may be.

Scotland

GLASGOW, April 6.

With various controls and proposed controls there is some uncertainty in the market generally but, on the whole, prices are fairly constant.

Crude gas-works tar.—Actual value is now 37s. to 39s. per ton *ex* works in bulk.

Pitch.—Supplies are not now readily procurable and vertical quality is valued at 35s. to 37s. 6d. per ton f.o.b. for export and about 35s. per ton *ex* works in bulk for home trade.

Refined tar.—Home price is maintained at 4½d. to 4¾d. per gallon, while quotations for export are now in the region of 2¾d. to 3¼d. per gallon, both f.o.r. naked.

Creosote oil.—Quite plentiful supplies are available with values as under : Specification oil, 5d. to 5¼d. per gallon ; low gravity, 6¼d. to 6½d. per gallon ; neutral oil, 5¼d. to 5¾d. per gallon ; all *ex* works in bulk.

Cresylic acid.—There is very little new business being placed and supplies are readily available at the following prices : Pale, 97/99%, 2s. 1d. to 2s. 3d. per gallon ; dark, 97/99%, 1s. 10d. to 2s. per gallon ; pale, 99/100%, 2s. 6d. to 2s. 9d. per gallon ; all *ex* works in buyers' packages.

Crude naphtha.—Supplies are well looked after at about 8d. to 8¼d. per gallon *ex* works in bulk, according to quality.

Solvent naphtha is unchanged with 90/160 grade at 1s. 8d. to 1s. 9d. per gallon and 90/190 heavy naphtha at about 1s. 4d. to 1s. 5d. per gallon.

Motor benzole is 1s. 6¼d. to 1s. 7d. per gallon.

Pyridine.—Prices are nominal at 18s. to 19s. per gallon for 90/160 grade and 20s. to 21s. per gallon for 90/140 grade.

Contracts Advertised

Dismantling Concentrated Liquor Plant.

Blackpool Gas Department. [p. 110.]

Water Gas Plant.

Newbury Gas Department. [p. 110.]

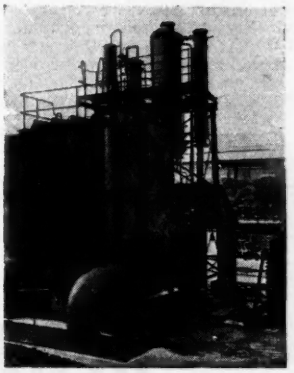
Stores.

Rhyl Gas and Water Department. [p. 110.]

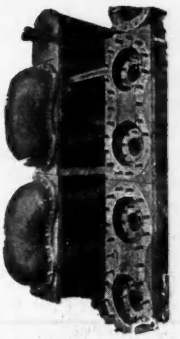
"Tangent" Electrical Products

Much useful information has been added to the new edition of the "Tangent" electrical products catalogue issued by Gent & Co., Ltd., Faraday Works, Leicester. The catalogue, comprising 82 pages, embraces a wide variety of bells, indicators, pushes, contacts and relays for office, institute and industry. There are marked improvements in the fire alarm systems described in the book, and a strong feature is made of the luminous call system which, it is noted, is replacing the more noisy bell system in many establishments. Many of the latest refinements mentioned in the catalogue have been installed in the new Cunard-White Star liner, the "Queen Elizabeth."

Permac
the all-purpose jointing



"Permac" joints in a Gas Works



"Permac" joints on Steam and Benzol Bye-product Plant. Right — covers removed for jointing.

"Permac" will make and keep tight every joint in your works—from the simplest to the most difficult—both flange and screwed pipe. It thus affords an important economy—dispensing with the need for keeping supplies of various jointings in stock. "Permac" stands up to all temperatures and pressures. Send for particulars.

Permac
METAL-TO-METAL JOINTING MATERIAL

Sole Manufacturers :

THOMAS & BISHOP LTD.
37, Tabernacle St.
LONDON, E.C.2

Telephone : Clerkenwell 3351 (2 lines). Telegrams : "Velcling," London.

For every size of works and every class of coal...

WEST'S

CARBONIZING PLANTS

GLOVER-WEST VERTICALS

WESTVERTICAL CHAMBERS

440 carbonizing plants have been built or are under construction by West's in 24 countries. Working results from a wide variety of gas coals have established the high efficiency and adaptability of the West systems.

WEST'S

GAS IMPROVEMENT CO · LTD ·

MILES PLATTING MANCHESTER 10

TELEPHONE—COLLYHURST 2961-2-3-4-5 · TELEGRAMS—STOKER, MANCHESTER

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GAS STOCKS AND SHARES

Markets were firm at the opening last week although some uneasiness developed later. This was followed at the close by more cheerful conditions and a firm tone. British Funds were better on the week, some showing gains of a point, while 2½% Consols improved ¼ at 72½, against 72¼ a week ago. Home rails closed with little change either way. The industrial market was stimulated by Dunlop's increased dividend and some leaders made good progress. Oil shares were steady and a number of rises took place among gold mining shares.

There was a fair volume of business in the Gas Market during the earlier part of the week, but in contrast to the other sections the activity fell away towards the close. More transactions than usual, however, were recorded on the Provincial Exchanges. There were few price changes in the Official List, though the majority of these were in an upward direction and included small gains in Tottenham and Wandsworth ordinaries. A parcel of Montevideo changed hands at 63 and the quotation was moved up 5 points to 62½. It will be seen that a few fixed-interest stocks also hardened. The only fall of note occurred in Imperial Continental which closed 4 lower at 78½. Several improvements were recorded in the Provinces. At Bristol, the local Company's stock gained a point and Bath consolidated closed 2½ higher at 103½, while at Newcastle Sunderland maximum rose 2 to 112. Nominal quotations in the Supplementary List remained unchanged.

The accounts of the Primitiva Gas Company of Buenos Aires, Ltd., show that gross revenue improved from £480,369 in 1938 to £531,746 for last year, although the net profit is £28,829 down at £161,442. The main reasons for this lower figure are additional taxation, £105,000 against £62,000, and the loss on exchange £190,629 against £152,874. The Directors are recommending a dividend of 1¾% free of income tax, against 2¼%. After allowing for this and allocations to reserves the amount carried forward is £76,585 against £77,634 brought in. The report states that under the terms of the 1920 contract the Company has been authorised to continue the supply of gas to the city of Buenos Aires to Aug. 15, 1940.

Official Quotations on the London Stock Exchange

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Apl. 5.	Rise or Fall on Week.
1,767,439	Mch. 11	8	7	Alliance & Dublin Ord. ...	108—113	...
374,000	Dec. 27	4	4	Do. 4 p.c. Deb. ...	80—90	...
877,576	Nov. 6	5	5	Ascd. Gas & Water U'd'ts Ord.	14/6—16/6	...
500,000	"	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	16/6—18/6	...
535,545	"	4	4	Do. 4 p.c. Red. Cum. Pref.	15/—17/—	...
318,730	"	4	4	Do. 4 p.c. Irred. Cum. Pref.	13/6—15/6	...
750,000	Mch. 18	3½	3½	Do. 3½ p.c. Red. Deb. ...	82—87	...
560,070	Feb. 19	7	7	Barnet Ord. 7 p.c.	122—127	...
300,000	Oct. 9	1/9⅜	1/4⅜	Bombay, Ltd.	20/—22/—	...
181,915	Feb. 26	9½	9½	Bournemouth Sliding Scale ...	145—150	...
690,526	"	7	7	Do. 7 p.c. max. ...	118—123	...
493,960	"	6	6	Do. 6 p.c. Pref. ...	116—121	...
50,000	Dec. 18	3	3	Do. 3 p.c. Deb. ...	70—75	...
362,025	"	4	4	Do. 4 p.c. Deb. ...	95—100	...
335,000	"	5	5	Do. 5 p.c. Deb. ...	105—110	...
357,900	Feb. 19	7½	6¾	Brighton, &c., 6 p.c. Con. ...	103—108	...
659,955	"	6¾	5⅞	Do. 5 p.c. Con. ...	100—105	...
205,500	"	6	6	Do. 6 p.c. 'B' Pref. ...	103—108	...
855,000	Mch. 11	7	8	British Ord.	98—108	...
100,000	Dec. 18	7	7	Do. 7 p.c. Pref.	120—125	...
350,000	"	5½	5½	Do. 5½ p.c. 'B' Cum. Pref.	110—115	...
120,000	"	4	4	Do. 4 p.c. Red. Deb.	73—78	...
450,000	"	5	5	Do. 5 p.c. Red. Deb.	100—105	+2
100,000	22 May '33	6	4	Cape Town, Ltd.	⅛—¾	...
100,000	6 Nov. '33	4½	4½	Do. 4½ p.c. Pref.	⅛—¾	...
150,000	Dec. 18	4½	4½	Do. 4½ p.c. Deb.	50—60	−5
626,860	Jan. 29	6	5 7/10	Cardiff Con. Ord.	103—108	...
237,860	Dec. 18	5	5	Do. 5 p.c. Red. Deb. ...	95—100	...
98,936	Oct. 9	2/—	2/—	Colombo Ord.	1⅛—1½	...
24,510	"	1/4⅜	1/4⅜	Do. 7 p.c. Pref.	20/6—22/6	...
739,453	Mch. 26	−/11.48	−/11.48	Colonial Gas Assn. Ltd. Ord. ...	14/6—16/6	...
296,144	"	1/3.30	1/3.30	Do. 8 p.c. Pref.	20/—22/—	...
1,775,005	Jan. 29	4	2	Commercial Ord.	47—52	...
140,000	Feb. 19	4	4	Do. 4 p.c. Red. Pref. ...	87—92	...
620,000	Dec. 11	3	3	Do. 3 p.c. Deb.	62—67	...
286,344	Feb. 19	5	5	Do. 5 p.c. Deb.	95—100	...
200,000	"	3⅜	3⅜	Do. 3⅜ p.c. Red. Deb. ...	93—98	...
807,560	Feb. 12	7	7	Croydon sliding scale	98—103	...
644,590	"	5	5	Do. max. div.	84—89	...
620,385	Dec. 7	5	5	Do. 5 p.c. Deb.	100—105	...
208,660	Feb. 19	5	5	Dudley, Brierley Hill & Dist. Ord.	98—103	...
82,275	"	5	5	Do. 5 p.c. Con. Pref. ...	93—98	...
79,000	"	3⅜	3⅜	Do. 3⅜ p.c. Red. Deb. ...	93—98	...
239,000	Jan. 29	5	88/6	East Hull Ord. 5 p.c.	80—90	...
187,215	Feb. 12	5⅜	5⅜	East Surrey Ord. 5 p.c. ...	93—98	...
176,211	Dec. 18	5	5	Do. 5 p.c. Deb. ...	100—105	...
250,000	Nov. 13	8	4	Gas Consolidation Ord. 'B' ...	14/—17/—	...
250,000	"	4	4	Do. 4 p.c. Red. Cum. Pref.	16/—18/—	...
19,152,410	Jan. 29	5⅜	3⅜	Gas Light & Coke Ord. ...	16/6—17/6a	...
2,600,000	"	3½	3½	Do. 3½ p.c. max.	62—67	...
4,477,106	"	4	4	Do. 4 p.c. Con. Pref. ...	86—91	...
2,993,000	Jan. 2	3⅜	3⅜	Do. 3⅜ p.c. Red. Pref. ...	87—92	...
8,602,497	Nov. 27	3	3	Do. 3 p.c. Con. Deb. ...	77—82	...
3,642,770	"	5	5	Do. 5 p.c. Red. Deb. ...	105—110	...
3,500,000	"	4½	4½	Do. 4½ p.c. Red. Deb. ...	102—107	...
700,000	Mch. 11	3½	3½	Do. 3½ p.c. Red. Ded. ...	87—92	...
270,466	Feb. 19	6	6	Harrogate New Cons.	93—98	...
157,500	Mar. 20	‡1/—	‡1/—	Hong Kong and China Ord. ...	⅛—¾	...
5,600,000	Oct. 23	12	4	Imperial Continental Cap. ...	76—81	−4
172,810	Jan. 29	3½	3½	Do. 3½ p.c. Red. Deb. ...	80—85	...
63,480	Dec. 18	3	3	Maidstone 3 p.c. Deb.	55—60	...
45,000		†10	†8	Malta & Mediterranean ...	92—102	...
				Metropolitan (of Melbourne) ...		
392,000	Apl. 1	5½	5½	5½ p.c. Red. Deb.	93—98*	−2
231,977	Feb. 19	5	5	M.S. Utility 'C' Cons.	75—80	...
968,658	"	4	4	Do. 4 p.c. Cons. Pref. ...	82—87	...
390,076	Dec. 18	4	4	Do. 4 p.c. Deb. ...	85—90	...
148,955	Dec. 18	5	5	M.S. Utility 5 p.c. Deb. ...	102—107	...
125,000	Jan. 2	3½	3½	Do. 3½ p.c. Red. Bds. ...	90—95	...
675,000	Nov. 6	†3	†4	Montevideo, Ltd.	60—65	+5
250,000	Mch. 18	7½	5 7/10	North Middlesex 6 p.c. Con. ...	103—108	...
396,160	Jan. 29	5	5	Northampton 5 p.c. max. ...	90—95	...
300,000	Nov. 6	†7	9	Oriental, Ltd.	118—123	...
468,537	Dec. 11	8	7	Plymouth & Stonehouse 5 p.c.	114—119	...
621,667	Feb. 5	8½	8⅜	Portsmouth & Gosport Cons.	110—115	...
241,446	"	5	5	Do. 5 p.c. max.	85—90	...
73,350	"	5	5	Do. 5 p.c. Pref.	90—95	...
75,000	"	4	4	Do. 4 p.c. Pref.	75—80	...
114,000	Feb. 5	5	5	Preston 5 p.c. Pref.	88—93	...
247,966	Dec. 18	4	4	Primitiva 4 p.c. Cons. Deb. ...	93—98	...
625,959	Jan. 15	4	4	Do. 4 p.c. Red. Deb. ...	91—96	...
15,000	Mch. 11	6	6	San Paulo 6 p.c. Cum. Pref. ...	7½—8½	...
441,275	Oct. 9	1/1½	1/1½	Severn Val. Gas Cor. Ld. Ord.	17/—19/—	...
460,810	Mch. 11	−/10⅜	−/10⅜	" " 4½ p.c. Cum. Pref. ...	16/6—18/6	...
133,201	Feb. 12	8½	5	Shrewsbury 5 p.c. Ord. ...	105—115	...
9,000	June 5	†4	†4	South African Ord.	4—5	...
1,996,297	Aug. 21	1/2⅜	1/2⅜	South East'n Gas Cn. Ld. Ord.	16/—18/—	...
1,000,000	Mch. 4	−/10⅜	−/10⅜	Do. 4½ p.c. Red. Cum. Pref.	16/6—18/6	...
769,191	"	4	4	Do. 4 p.c. Cum. Pref. ...	15/—17/—	+/6
450,000	Feb. 12	4	4	Do. 4 p.c. Red. Deb. ...	95—100	...
150,000	"	3½	3½	Do. 3½ p.c. Red. Deb. ...	89—94	...
6,709,895	"	5	4	South Met. Ord.	70—75	...
1,135,812	"	6	6	Do. 6 p.c. Irred. Pref. ...	106—111	...
850,000	"	4	4	Do. 4 p.c. Irred. Pref. ...	80—85	...
1,895,445	Dec. 27	3	3	Do. 3 p.c. Deb.	71—76	...
1,000,000	Jan. 15	5	5	Do. 5 p.c. Red. Deb. ...	102—107	...
600,000	"	3⅜	3⅜	Do. 3⅜ p.c. Red. Deb. ...	92—97	...
1,543,795	Feb. 5	6	3	South Suburban Ord. 5 p.c. ...	77—82	...
512,925	"	5	5	Do. 5 p.c. Pref.	95—100	...
500,000	"	4	4	Do. 4 p.c. Pref.	82—87	...
250,000	"	3⅜	3⅜	Do. 3⅜ p.c. Red. Pref. ...	86—91	...
888,587	Dec. 11	5	5	Do. 5 p.c. Deb.	105—110	+2
250,000	"	4	4	Do. 4 p.c. Deb.	85—90	...
200,000	Feb. 12	3½	3½	Do. 3½ p.c. Red. Deb. ...	87—92	...
427,859	Sept. 18	1/2⅜	9⅜	S. Western Gas & Water Ord.	13/6—15/6	...
160,523	Oct. 9	−/10⅜	−/10⅜	Do. 4½ p.c. Red. Cum. Pref.	17/6—19/6	...
110,000	Dec. 18	4	4	Do. 4 p.c. Red. Deb. ...	90—95	...
750,541	Feb. 5	5	5½	Southampton Ord. 5 p.c. ...	77—82	...
148,836	Dec. 27	4	4	Do. 4 p.c. Deb.	85—90	...
350,000	Feb. 12	5½	5½	Swansea 5½ p.c. Red. Pref. ...	97—102	...
200,000	Dec. 18	3½	3½	Do. 3½ p.c. Red. Deb. ...	90—100	...
1,076,490	Feb. 26	6½	5	Tottenham and District Ord....	94—99	+1
409,835	"	5½	5½	Do. 5½ p.c. Pref.	103—108	...
62,235	"	5	5	Do. 5 p.c. Pref.	95—100	...
453,380	Dec. 11	4	4	Do. 4 p.c. Deb.	85—90	...
1,247,505	Oct. 23	6	4	U. Kingdom Gas Cor. Ord. ...	14/—16/—	...
1,085,952	Nov. 20	4½	4½	Do. 4½ p.c. 1st Cum. Pref. ...	15/—17/—	...
772,709	"	4	4	Do. 4 p.c. 1st Red. Cum. Pf.	14/6—16/6	...
745,263	Dec. 18	4½	4½	Do. 4½ p.c. 2nd Non-Cum. Pf.	13/6—15/6	...
1,093,656	Mch. 18	3½	3½	Do. 3½ p.c. Red. Deb. ...	84—89	...
378,106	Mch. 11	7	7	Uxbridge, &c., 5 p.c.	95—105	...
133,010	"	5	5	Do. 5 p.c. Pref. ...	95—100	...
1,371,138	Feb. 5	6½	3½	Wandsworth Consolidated ...	88—93	+1
2,525,768	"	4	4	Do. 4 p.c. Pref.	84—89	...
1,343,964	Dec. 18	5	5	Do. 5 p.c. Deb.	103—108	...
383,745	"	4	4	Do. 4 p.c. Deb.	85—90	...
400,000	"	3½	3½	Do. 3½ p.c. Red. Deb. ...	90—95	...
558,342	Jan. 29	6½	6	Watford and St. Albans Ord. ...	95—100	...
200,000	"	5	5	Do. 5 p.c. Pref.	95—100	...
200,000	"	5½	5½	Do. 5½ p.c. Pref.	100—105	...
200,000	"	4	4	Do. 4 p.c. Rd. Pf. (1973/8)	85—90	...
100,000	"	33/4§	4	Do. 4 p.c. Red. Pf. (1959)	93—98	...
200,000	Dec. 11	3½	3½	Do. 3½ p.c. Red. Deb. ...	83—88	...

a.—The quotation is per £1 of Stock. * Ex. Div. † Paid free of income-tax. ‡ For year. § Actual.

Supplementary List and Provincial Exchanges overleaf.

STOCK AND SHARE LIST—Contd.

Supplementary List, not Officially Quoted, London

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Nominal Quotations Apl. 5.	Rise or Fall on Week.
202,152	Mch. 18	5	5	Ascot Ord.	80—85	...
128,182	Dec. 27	5	5	Do. 5 p.c. Pref. ...	88—93	...
31,035	Mch. 4	-/9⅝	-/9⅝	Associated Utilities 4 p.c. Pref.	15/—17/-	...
100,000	Dec. 18	3½	3½	Do. 3½ p.c. Red. Deb. ...	90—95	...
17,000	Feb. 19	8	8	Bognor Orig. Ord. 'A' ...	102—112	...
62,210	,,	8	8	Do. New Add. 'A' ...	102—112	...
87,160	,,	7	7	Do. New 7 p.c. max. ...	95—105	...
37,440	Jan. 29	10	10	Cam. Univ. & Town 10 p.c. max.	145—155	...
125,970	,,	7	7	Do. 7 p.c. max.	105—115	...
39,025	,,	5	5	Do. 5 p.c. max.	80—90	...
96,410	Jan. 29	4½	4½	Cardiff 4½ p.c. Pref.	90—95	...
55,520	Feb. 19	6	6	Colchester 6 p.c. Pref.	95—100	...
90,550	Mch. 18	5	5	Do. 5 p.c. Deb. ...	98—103	...
150,000	Feb. 12	4	4	Croydon 4 p.c. Pref.	82—87	...
130,000	Dec. 27	4	4	Do. 4 p.c. Deb.	85—90	...
65,000	Mch. 4	7½	6⅞	Eastbourne 'A' 5 p.c.	105—115	...
198,000	,,	6	5⅝	Do. 'B' 3½ p.c.	90—100	...
112,312	,,	5	5	Do. 5 p.c. Pref.	90—95	...
130,000	Dec. 18	5	5	Do. 5 p.c. Deb.	98—103	...
130,500	Feb. 19	7½	7½	Exeter New Ord. (£10) ...	10—12	...
24,000	Aug. 21	8½	8½	Gt. Yarmouth 8½ p.c. max. (£30)	15—20	...
59,400	,,	7½	7½	Do. 7½ p.c. max. (£30) ...	10—15	...
51,160	Dec. 11	5½	5½	Do. 5½ p.c. Deb.	102—107	...
152,600	Feb. 26	8	9	Guildford Cons.	110—120	...
54,055	,,	5	5	Do. 5 p.c. Pref.	90—95	...
68,250	Dec. 11	5	5	Do. 5 p.c. Deb.	90—95	...
156,600	Feb. 19	7	5	Hampton Court Cons.	75—85	...
86,046	June 19	‡4½	‡5	Holyh'd&N.W.G.&W.Cpn.Ord.	13/6—15/6	...
80,000	Feb. 12	4	4	Lea Bridge 4 p.c. Pref.	65—75	...
60,000	,,	6	6	Do. 6 p.c. Pref.	105—115	...
94,876	Dec. 18	4	4	Do. 4 p.c. Deb.	75—80	...
73,620	Mch. 18	8¾	8¾	Luton Cons. 'A'	115—125	...
107,960	Feb. 26	4	5¼	Mid Kent Ord. (£10)	7¼—8¼	...
230,940	Feb. 5	10	10	Oxford & District Ord. ...	135—145	...
47,112	,,	5	5	Do. 5 p.c. Pref.	85—90	...
50,000	,,	6	6	Do. 6 p.c. Red. Pref. ...	100—105	...
126,193	Oct. 30	7½	7½	Peterborough Ord.	140—150	...
64,990	Mch. 18	7	7	Redditch Ord.	105—110	...
166,850	Feb. 19	8	8	Romford Ord.	108—118	...
60,000	,,	4	4	Do. 4 p.c. Pref.	85—90	...
44,000	Mch. 18	5	5	Do. 5 p.c. Deb.	97—102	...
25,570	Feb. 12	5½	5½	Rugby 5½ p.c. Pref.	95—105	...
25,000	,,	6	6	Do. 6 p.c. Red. Pref. ...	100—105	...
42,750	De. 11	5½	5½	Do. 5½ p.c. Deb.	103—108	...
110,950	Feb. 26	8	8	Ryde Ord.	100—110	...
270,086	Mch. 18	7	7	Slough Ord.	98—103	...
21,000	Dec. 11	5	5	Do. 5 p.c. Deb.	92—97	...
28,872	Nov. 6	5½	5½	S. Midland Gas Cpn. Ltd. Ord.	14/—16/-	...
28,866	Mch. 18	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	14/—16/-	...
127,228	Feb. 19	5	7	Swindon Cons.	75—80	...
60,425	Dec. 18	5	5	Do. 5 p.c. Deb.	92—97	...
64,380	,,	5	5	Torquay & Paignton 5 p.c. Pref.	82—87	...
130,000	Feb. 12	5	5	Wakefield Ord.	85—95	...
81,650	,,	5	5	Do. 5 p.c. max.	75—80	...
82,000	Jan. 29	6	6	Weymouth Ord.	82—87	...
273,626	Feb. 12	7	7	Wolverhampton Cons. Ord. ...	115—125	...
98,384	,,	6	6	Do. 6 p.c. Pref.	105—115	...
160,000	Dec. 18	5½	5½	Do. 5½ p.c. Red. Deb. ...	100—105	...
106,490	Mch. 18	5½	5½	Wrexham Ord	75—85	...
90,000	Dec. 18	5	5	York 5 p.c. Red. Deb.	95—100	...
133,640	Feb. 19	6	6	Yorktown (Cam.) 5 p.c. Cons.	82—87	...
120,000	,,	5	5	Do. 5 p.c. Pref.	85—90	...
35,000	Dec. 18	5½	5½	Do. 5½ p.c. Deb.	103—108	...

BRISTOL EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Apl. 5.	Rise or Fall on Week
347,756	Feb. 12	5	6	Bath Cons.	102—105	+2½
1,667,250	Feb. 5	5	5	Bristol, 5 p.c. max.	104—106	+1
120,420	Dec. 18	4	4	Do. 1st 4 p.c. Deb. ...	98—101	...
415,250	,,	4	4	Do. 2nd 4 p.c. Deb. ...	98—101	...
328,790	,,	5	5	Do. 5 p.c. Deb.	115—117	+1½
274,000	Feb. 26	5	5	Newport (Mon.) Ord.... ...	91—94	...
13,200	Mch. 26	7	8⅝	Pontyp'l Gas & W. 10 p.c. 'A'	11⅜—12⅝	..
13,600	,,	5	6	Do. 7 p.c. 'B'	10½—10⅝	...
40,000	,,	5	6	Do. 7 p.c. 'C'	10½—10⅝	...
140,778	Feb. 12	5	5	Weston-super-Mare Cons. ...	92—96	...
64,338	Dec. 27	4	4	Do. 4 p.c. Deb.	90—95	...
33,340	,,	7½	7½	Do. 7½ p.c. Deb.	140—150	...

LIVERPOOL EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Apl. 5.	Rise or Fall on Week
157,150	Feb. 5	5	6½	Chester 5 p.c. Ord.	98—101	...
92,500	Dec. 18	4	4	Do. 4 p.c. Pref.	80—84	...
36,430	,,	3½	3½	Do. 3½ p.c. Deb.	85—88	...
41,890	,,	4	4	Do. 4 p.c. Red. Deb. ...	95—99	..
2,167,410	Feb. 19	6	6	Liverpool 5 p.c. Ord.	105—107	...
245,500	Dec. 18	5	5	Do. 5 p.c. Red Pref. ...	95—100	...
306,083	July 17	4	4	Do. 4 p.c. Deb.	99—101	...
105,280	Feb. 5	10	8	Preston 'A' 10 p.c.	165—175	...
188,219	,,	7	7	Do. 'B' 7 p.c.	123½—133½	..

NEWCASTLE EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Apl. 5.	Rise or Fall on Week
122,577	Feb. 19	7	7	Blyth 5 p.c. Ord.	113—118	...
732,000	Feb. 19	4	4	Hartlepool G. & W. Co. & New	63½—64½	...
2,430,267	Feb. 5	5	5 7/10	Newcastle & Gateshead Con.	20/—20/6o	...
682,856	,,	4	4	Do. 4 p.c. Pref.	89—91	...
776,706	Dec. 27	3½	3½	Do. 3½ p.c. Deb.	84—86	...
277,285	April 24	5	5	Do. 5 p.c. Deb. '43 ...	101—103	...
332,351	Feb. 5	6	6	Sunderland 6 p.c. max. ...	111—113	+2

NOTTINGHAM EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Apl. 5.	Rise or Fall on Week
542,270	Feb. 12	6	9	Derby Con.	103—108	...
55,000	Dec. 18	4	4	Do. 4 p.c. Deb.	98—103	...
20,000	Dec. 18	5	5	Long Eaton 5 p.c. Pref. ...	9—11	...
80,000	,,	5	5	Do. 5 p.c. Deb. ...	100—105	...

SHEFFIELD EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Apl. 5.	Rise or Fall on Week
10,000	Feb. 19	10	10	Great Grimsby 'A' Ord. ...	170—180	...
6,500	,,	10	10	Do. 'B' Ord. ...	170—180	...
79,000	,,	10	10	Do. 'C' Ord. ...	160—170	...
1,806,339	Feb. 26	6½	6½	Sheffield Cons.	123—125	...
95,000	Jan. 2	4	4	Do. 4 p.c. Deb.	98—100	..

a The quotation is per £1 of Stock.
* Ex. div. ‡ For year.

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